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BRIDGES - BUILDINGS - CONTRACTING - SIGNALING - TRACK

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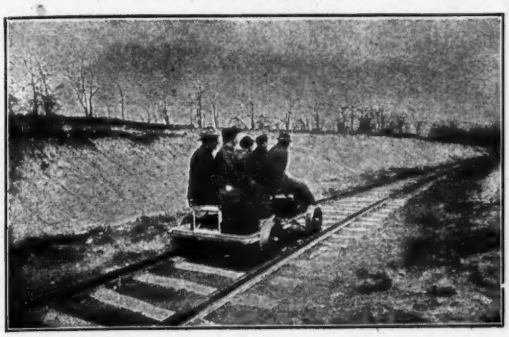

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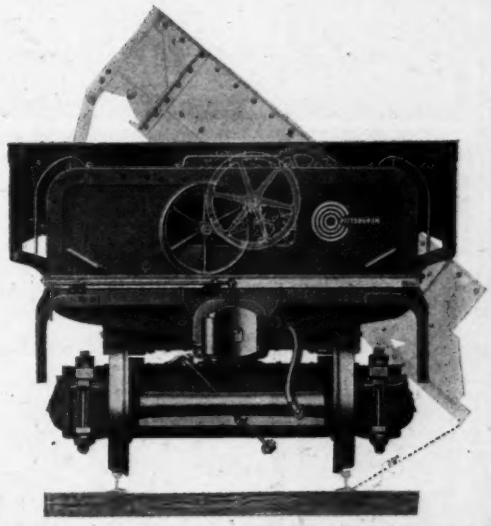

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CONTENTS.

*Illustrated.

Bridge and Building Association.

THE American Railway Bridge and Building Association will hold its twenty third annual convention at Hotel Windsor, Montreal, Que., October 14-16.

The work this association has been doing assures an interesting and profitable meeting. The membership is composed of a large number of the most progressive railway bridge and building men, who are taking an active interest in and supporting the association's work.

Committee reports were submitted last year on the following subjects: Fire resisting paints (progress); Derricks, etc., forhandling material in yards; Concrete tanks and reservoirs; Reinforced concrete culvert pipe; Water supply—long pipe lines, etc.; Turntables; Painting structural iron and steel; Relative merits of brick and concrete in railway buildings and platforms.

All these subjects touch on questions of vital interest. The tendency towards better protection of structures is shown by two of the reports dealing with protective paints. It is worthy of note that these relate to the protection of steel and wood, both of which materials are being used less as concrete is used more, one of the advantages of concrete being its passivity toward the elements, no coating being required as a protection against fire or water.

The report on the subject of turntables is the most thorough and extensive study ever conducted on this subject and ranks as a classic. The chairman of this committee was C. E. Smith, recently appointed assistant chief engineer of the Missouri Pacific Ry., and the information with respect to the inadequacy of both the structural members of turntables and also turntable bearings now in use, has already resulted in the design of turntables which are capable of handling the loads imposed on them without straining the materials or bearings beyond safe limits. The accurate analysis of the subject proved that the method of designing using Cooper's loadings leads to erroneous results, and that a careful analysis is necessary in the assumptions as to loading.

Turntables seem to have been neglected by railways, as a whole, which has resulted in the manufacturers designing them and the railways accepting them generally without detailed checking.

The other reports and discussions in the 1912 proceedings are instructive and valuable, dealing as they do with timely subjects. The proceedings contain 330 pages and a large number of illustrations, and are gotten out in exceptionally neat and systematic shape, making an attractive looking and valuable volume.

The subject of track scales, which is to be reported on at Montreal, is another which has been so small as to escape careful attention, on account of the great problems constantly arising in the railway field. It is not an exception to the rule to have an inquiry for information on scales at a railway office, result in plans being brought out which were gotten out entirely by the manufacturer, with little or no attention by the railway. This report will also be of more than usual interest.

This convention bids fair to be more interesting and profitable than ever before.

Tunnel Lining.

THE RISK of lining tunnels with wooden shoring, as has been the almost universal practice in the West, is exemplified in the experience of the Southern Pacific which road has been practically out of commission, so far as its California "Shore Line" is concerned, for several weeks by reason of an uncontroliable fire in one of its largest tunnels. The loss resulting from the closing of an artery of traffic for days or weeks and, as may not unreasonably be expected, even months, is too great to warrant risking the cheaper construction in tunnel work. Where the nature of the soil tunnelled is loose and unstable, the only permanent lining practicable is concrete, and that must be well placed.

A tunnel fire is a difficult thing to fight. The usual method is to smother it by sealing the tunnel ends, but the process is a slow one.

The very presence of a tunnel is an indication that a detour would be expensive or impossible. For that reason tunnels form the most important class of structures on a railway line. Their construction, therefore, should be of a grade in accordance with their importance as operating links.

Most of the western railways were built with limited capital and permanency in structure was sacrificed to mileage on this account. With the first available funds, wooden tunnel lining should be supplanted by concrete.

Grade Crossings.

IN THE eastern and central states, agitation against the grade crossing is growing apace. An accident here and an accident there has done much to attract the attention of those schooled in the political advantages of the inception of regulatory legislation. It is not beyond the possibilities that some central state will follow the lead of New Jersey and compel the elimination of grade crossings with the proviso that the expense for said elimination will fall upon the railways. Politicians will be slower to initiate such action if any great part of the expense were to fall directly upon the commonwealth.

The argument is not that highway-railway crossings should not be made safe. No sane person would fail to acknowledge the need for greater safety; but the point is, country grade crossings can be made absolutely safe for the passage of any but maniacs or drunken joy riders. Separation of grades in any but congested districts where signals would be confusing, is unnecessary to public safety.

There are many automatic crossing protection devices on the market and almost any one of them, properly installed, furnishes ample protection. Their operation can be made as sure as that of the automatic block signal—perhaps more so, as the mechanism is simple.

If there is to be any general policy of separation it should be between the gasoline joy wagon and its irresponsible driver.

GO AHEAD.

Geo. W. Light.

Do not ask too broad a test—
Go ahead;
Lagging never clears the sight;
When you do your duty best,
You will best know what is right.
Go ahead.

—*The Scoop.*

Tools.

THE ROADMASTER who is monotonously handed inferior track tools because they cost less, might profitably study the methods of the master boiler maker in the division shops. On of the largest of manufacturers of boiler repair tools was recently heard to remark that his best tools invariably go to the railways because the industrial trade will not pay the price. It is common knowledge that manufacturers of track tools have found that the situation with respect to their output is not so encouraging. Track tools are too often bought on price alone, although the loss in efficiency due to this fact is probably greater than it would be in the boiler shop, where other facilities are convenient.

There should be a reason for this variation of policy and it is up the loyal roadmaster to make an effort to locate the difficulty.

By the Ad Editor.

IT IS a universally acknowledged fact that cost of production is appreciably lowered by manufacturing articles in quantities. It is also true that when manufactured in quantities, the price of an article gradually lowers, other things being equal, due to the increased supply as compared with the demand.

The greater the quantity of raw material made up by a certain set of men in a manufacturing establishment, the more skillful the workmen become, and the better the quality of the articles produced. The seasonal fluctuations in trade demand have a lesser effect on an establishment doing a large business than on one doing a small business, and a sudden demand is also more easily cared for by a large concern. Finally, in the cost of raw products, the advantage is with the buyer of large quantities.

Profits are made in two ways: (1) by charging high prices and profits on few sales; (2) or by charging low profits on many sales.

The concerns which are energetically pushing their businesses by advertising, are creating a greater demand for their wares, making more turnovers, i. e., doing business in quantities, and as a result generally produce better and more economical wares than the concerns which remain small through lack of carefully chosen publicity methods.

The Ann Arbor is ready to begin work this fall on the new yards and shops at Owosso, Mich. An expenditure of about $400,000 is contemplated.

The Baltimore & Ohio, it is reported, will expend $500,000 for terminal improvements at Parkersburg, W. Va., which will include a new freight house and additional tracks.

The Denver & Rio Grande has let a contract to the Continental Contract Co. for the construction of a freight terminal at Ogden, Utah, to cost about $35,000. It will include a two-story office building and a freight shed.

The Grand Trunk is taking bids on its proposed freight and passenger station to be erected at Black Rock terminal, Buffalo, N. Y. They will be of brick and steel; the passenger station being 116 x 33 ft. and the freight depot, 119 x 20 ft.

The Joplin Union Station Co., Joplin, Mo., is said to have let contract at $62,500 for improvements to the present depot. Train sheds will be erected and other improvements made.

The Kansas City Terminal has awarded contract to the Gale Construction Co. for a 16-stall roundhouse at Kansas City, Mo.

Illinois River Bridge, St. L. P. & N.-W. Ry

The St. Louis, Peoria & North Western Ry. has recently completed its new single track bridge over the Illinois River, at Pekin, Ill.

As shown on the plan and elevation, the structure is 926 ft. 3 ins. center to center of end pins, and consists of two deck girders on the southwest end with length of 70 ft. 3 ins. and 71 ft. 4½ ins. respectively, center to center of piers; three through truss spans, 152 ft. 6 ins., 153 ft. 6 ins. and 151 ft. ¾ ins. center to center of piers; one Waddell and Harrington vertical lift through truss span, 177 ft. 6 ins. center to center of piers; and one through span 150 ft. ¾ ins. center to center of piers. All through spans are multiple intersection trusses.

There is about two or three hundred feet of pile trestle approach at each end of the bridge, and therefore no abutments are needed. The end piers are similar in shape to the intermediate piers.

The track is tangent across the entire bridge and for a considerable distance beyond either end. The gradient is ascending 0.3 % to the south. These features, together with the simplicity of foundations indicates that the bridge was located very advantageously, despite the fact that shale is about 62 to 65 ft. below low water, only four pneumatic caissons were necessary.

completed since the last high water, and this retarded the flow so that a new high record was established, but the high water mark was not reached at Peoria, only 10 or 12 miles away. The high water did not interfere with construction in any way.

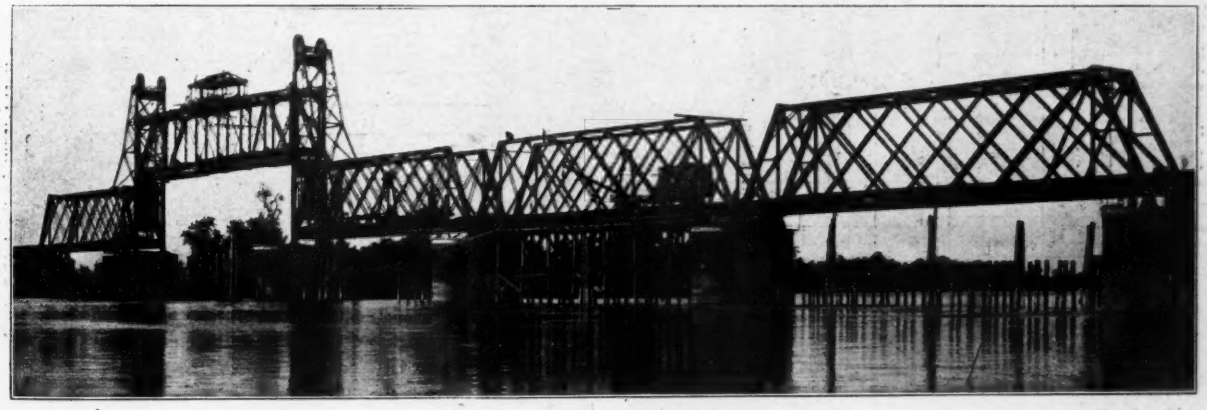
A map of the river was plotted for a considerable distance each side of the bridge location, this map giving full details of the country adjacent the site.

A large number of test borings were made during the summer of 1911, to determine the nature of the strata underneath the river bottom. A boring 1,800 ft. northeast of bridge site in center of river, showed 13 ft. of mud, 3 ft. of sand and gravel, and 8 ft. of slate clay. A boring about 1,200 ft. southwest, in center of river, showed 1 ft. of sand, 10 ft. of mud, and 11 ft, of slate clay.

Borings were also made 25 ft. upstream and downstream from the center line of each pier. At the north end, sand and gravel were encountered at elevation 399, and the south end the gravel crops out at the bed of the river, about 437. Shale is at elevation 372.2 at north and 382.9 at south end. There is a little mud at the north end, but the bed of the river for the most part is sand and clay, or blue clay.

The earth surface beyond each end of the bridge, is very marshy, and a large sink hole has developed on the north.

The loading on the shale, for the most extreme case of com-



Pekin River Bridge, Lift Span Open.

Substructure.

The piers are all constructed for double track, the second track to be added east of the single track now built. The road runs to the coal fields of southern Illinois, and as soon as completed, it obtained a heavy tonnage of coal traffic. The provisions for second track indicate that the officials expect the traffic to develop sufficiently to require two tracks within a comparatively short time.

All piers except the channel piers, are at right angles to the center line of the bridge. The channel piers are skewed at an angle of 73 deg. to parallel the channel, giving a clear opening of 150 ft.

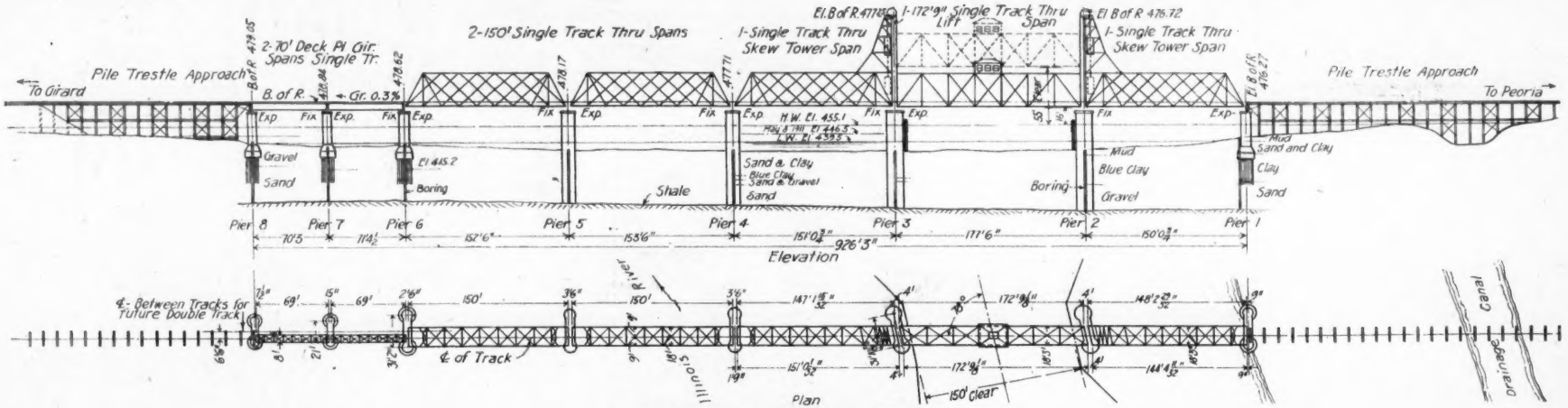
The low water mark, obtained from the government gauge at Pekin in 1901, is 439.7, and the high water elevation is 455.4, occurring in 1904. The elevation of the top of pier at north end is 467.21, and at south end is 469.99, giving a minimum height of 15.7 ft. above greatest recorded height of water.

A slightly higher gauge of water was experienced locally at Pekin last spring, but this did not affect the high water mark at Peoria. The Chicago drainage canal empties into the Illinois river, and tends to keep the water at more uniform elevation. Drainage projects are frequently being put in, which confine the water to smaller areas, causing higher water elevations. It was such a local cause that made the slightly higher water mark last spring. A drainage project had been

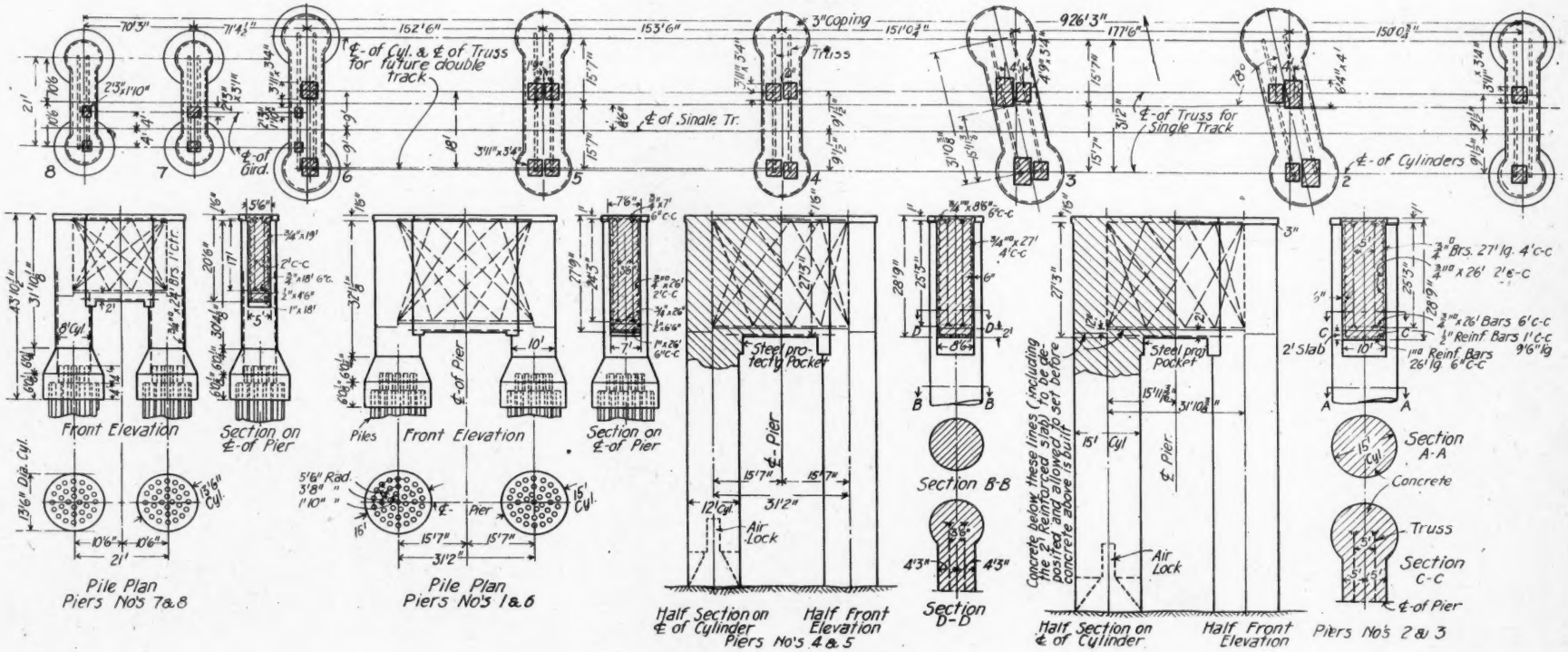
bination of maximum dead load, live load, load from traction force, wind load and eccentric load, is 111,000, lbs. per square ft., neglecting the frictional resistance of the soil, the buoyancy, and the resistance of the earth to column action. The maximum loading on any pile, under similar assumptions is 92.600 lbs. The bearing on concrete, under shoes, is 400 lbs. per square inch. It is interesting to note that the maximum wind load, under the above assumptions, with the long pier columns, is produced when blowing longitudinally against the bridge.

The piers are all cylinder piers of an unusual design. The piers and cylinders vary in size and depth; the cylinders are in each case anchored together at the top by a steel truss, of varying size but similar design, encased in concrete.

The cylinder footings for end piers are 13 ft. 6 ins. in diameter and 6 ft. thick, resting on 32 piles 50 ft. long. These piles were driven without a follower, and were required to be jettied down if necessary. Above the footing, the pier is offset to an 8 ft. diameter, the offset being a slope of 2 ft. 9 ins. horizontal to 6 ft. ¼ in. vertical. The height of the cylinders for piers 7 and 8, is 43 ft. 10½ ins., the coping is of concrete, 1 ft. 6 ins. thick. The trusses connecting the cylinders are 20 ft. 6 ins. high, 2 ft. apart center to center, latticed with 4 angles in pairs in both top and bottom chords. These trusses extend to the center of each cylinder. The concrete slab encasing



General Plan and Elevation of Bridge.

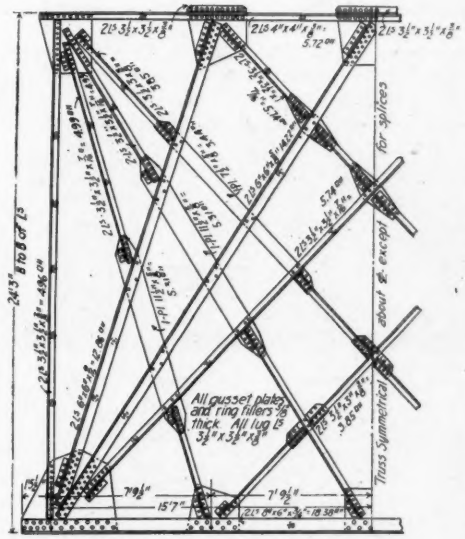


Details of Twin Cylinder Piers.

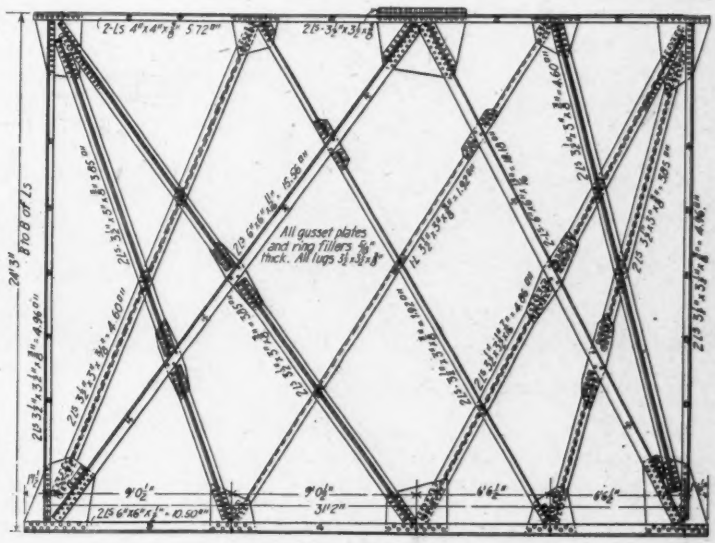
these trusses is reinforced with ¾ in. horizontal bars, 18 ft. long, near each side on 2 ft. centers, and by a row of ten 1 in. square bars 18 ft. long near bottom of slab, on 6 in. centers. A second horizontal row of ¾ in. horizontal square bars 18 ft. long, on 6 in. centers, is placed just above the lower angles of the truss. There is also a row of lateral ½ in square horizontal bars 4 ft. 6 ins. long in the bottom of beam. The distance between cylinder centers is 21 ft., and the length of bars being 18 ft., these bars will end 1 ft. 6 ins. from center of cylinder, which gives them a bond of 2 ft. 6 ins. in the cylinder concrete. The reinforcing bars were not considered in the design for ordinary stresses, but were added for temperature and unusual strains.

The connection between pier cylinders is made very rigid by this system, the more common system being the use of reinforced slabs only.

All cylinders resting on piles have spread footings in order to obtain room for the required number of foundation piles. Piers 7 and 8 are the same size. Cylinders 1 and 6 are the same size, with a footing diameter of 15 ft., and a cylinder body diameter of 10 ft., and a height of 45 ft. 7⅛ ins. These cylinders are 31 ft. 2 ins. on center and of course require larger trusses.



Truss X-1 and X-6 for Piers 1 and 6.



Truss Y-1 and Y-6 for Piers 1 and 6.

Piers, 5, 4, 3 and 2 rest on shale and have uniform diameters from under coping to bottom of footing.

Piers 4 and 5 have 12 ft. diameter cylinders. The cylinders in pier 4 average 88¼ ft. in height, and those in pier 5 average 92.35 ft. in length. The connection of tops of all pier cylinders are similar to those described in piers 7 and 8, and typical trusses are shown in detail. The piers are 31 ft. 2 ins. center to center.

Piers 2 and 3 support the vertical lift truss of 150 ft, clear span. These piers are on a skew of 78 deg., and are of larger section and taller than any of the others. The diameter of each is 15 ft. The average height of cylinders in pier 3 is 94.95 ft., and in pier 2 is 94.47 ft. The cylinders are 31 ft. 10⅜ ins. on centers.

The tops of all piers have a concrete coping, 1 ft. 6 ins. thick, built monolithic with the pier bodies.

The foundations, all cylinder piers, present an economy of material, a rigidity of connection, an economy in the construction method used (described later), which, together with the design of the piers in pairs with the same dimensions, thus simplifying form work, show excellent engineering judgment in engineering design.

The mixtures used were as follows: Body of piers, 1:3:5, (except working chamber in pneumatic piers, which was 1:2:4), copings, 1:2:4. The course aggregate was washed gravel.

Cylinder Trusses.

Five designs of trusses were required for the 5 sizes of piers. In all piers except Nos. 1 and 6, the two trusses, which are on 3 ft. 6 ins. centers, are the same size and design. Owing to the unequal loading on each of these piers, two sizes of trusses were used in each; however, this problem was simplified by making two types of trusses, one each of which was used in pier 6, and one each in pier 1, the arrangement being reversed, however. At pier 6, as shown in the plan, the span on the northeast side is 152 ft. 6 ins., and on the southwest only 71 ft. 4½ ins. The unequal load carried to the pier by the long span, causes a bending moment and tension toward the opposite side of the pier, which accounts for the heavier truss, labeled "X-1" or "X-6" in the diagram, on the opposite side of the center of cross beam. Trusses "X-1" and "Y-1" shown herewith illustrate this point.

The unit stresses used in designing these trusses were assumed as follows: for structural steel, tension and compression, 16,000 lbs. per square inch; bearing for shop rivets, 24,000 lbs., and for field rivets, 20,000 lbs. per square inch; shear, one-half of bearing.

Shapes and plates are of open hearth steel. Rivets are of rivet steel, of ⅞ in. diameter, in 1⅛ in. holes.

The loading used in the design of these trusses, was the maximum superstructure shoe reaction, plus weight of concrete cross beam.

Superstructure.

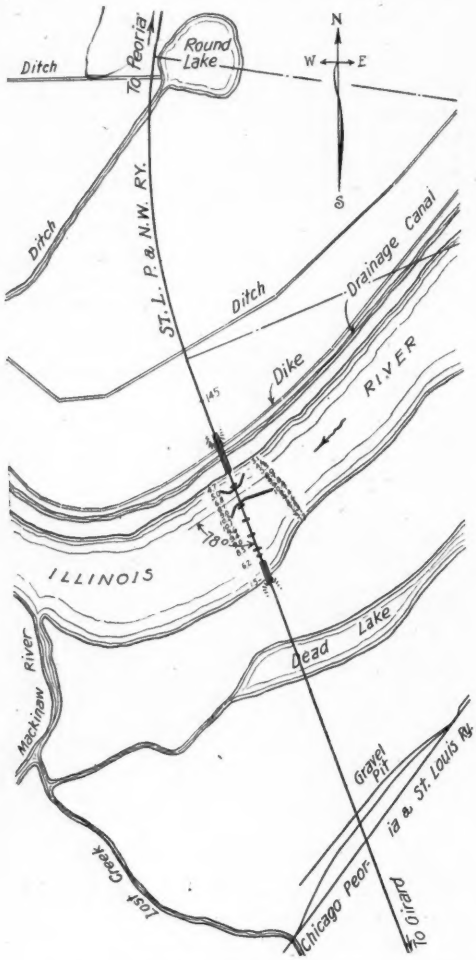
The superstructure consists of two deck girders, four riveted through trusses, and one pin connected through truss lifting span.

The rails, spikes, etc., were assumed at 100 lbs. per lineal ft., and the timber at 3.5 lbs. per lineal ft. The floor system, as well as the trusses, were designed for coopers E-55, with an impact of $I = L \times \frac{L}{L + D}$.

The multiple intersection trusses used, shown in one of the illustrations, have been adopted quite generally by the C. & N. W. Ry. The length of unsupported column sections is reduced considerably in the design, with a corresponding increase in number of riveted joints.

Instead of indicating the size of the sections on the super-

structure plans, these are given in tabular form on the lower parts of the drawings. A section with dimensions is placed opposite the description of each section. The maximum section in the lift span, the end strut, has a section of 66.68 sq. in., consisting of three plates and six angles, forming a partly closed box girder. The loading on this span is materially increased by the tower in the center.



Location Plan, Pekin River Bridge.

The maximum section of the adjacent skew spans, in the end strut is 49.58 sq. ins. consisting of three plates, four angles, and two bars, forming an open box girder.

Provision for second track was made in the superstructure design. Standard spans which could be used elsewhere were not affected. The towers were designed heavy enough, and with bracing and other details which may be adopted to a double track span.

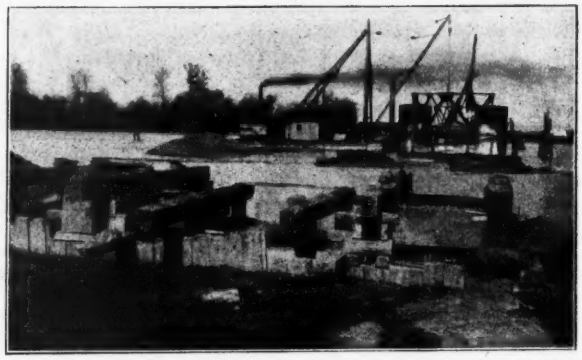
Construction.

The pier points were set by triangulation from two base lines on opposite sides of the river, one on the south 500 ft. long, the other on the north 1,088 ft. long.

Piles were driven from a barge, after excavating in open pits with a dredge to give the depth to bottom of footings. Piles were sawed off by means of an arbor saw at two heights, as shown on the general elevation. The interior piles extend up into the body of piers, and could therefore be made with higher cut-off than outside piles.

The piles were driven in gravel without a follower, it being required to jetty them down if necessary to obtain desired penetration.

Instead of using a coffer dam, the piers on piles were built



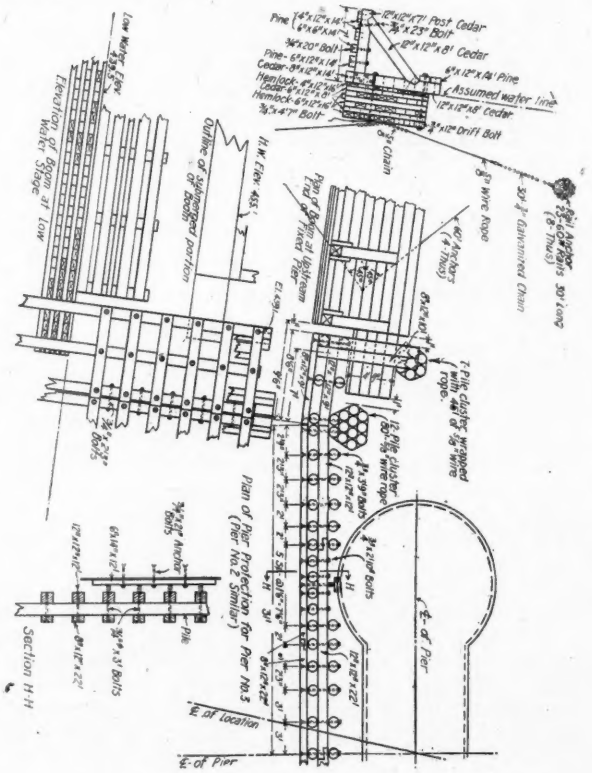
Placing Trusses Between Cylinders.

inside a steel shell, shown herewith. This shell takes the place of both coffer dam and form.

These shells are placed with a derrick, inside of a pile and plank bulwark. The protecting boom used in this case, is of interest, being of heavy construction and anchored in such manner as to thoroughly protect the piers. The anchorage chains are fastened to anchors 60 ft. up stream, at an angle of 45 deg. with the center line of boom. The chains are fastened on rollers on the boom, and adjusted by winding up or loosening at pleasure, locking with a bar through an eye in the roller.

After the steel shell was placed, concrete for the footings and up to water level was placed with a drop bottom bucket, under water. The steel shells had the necessary flare to provide for the footings. Above the water, concrete was also placed with a bucket, no concrete being chuted to place. After being filled, the steel shells are left in place, and serve to protect the piers from being chipped off or nicked by floating ice, etc.

The pneumatic caissons were sunk in the usual manner, by filling the upper chamber with concrete as the work progressed. The excavated material was blown out through a pipe passing through the concrete.



Details of Booms for Channel Piers.

The concrete plant was installed on a barge, with a cement storage shed on one end. Washed gravel was towed in on barges from Chillicothe by the Peoria Sand and Gravel Co.

The gravel barge was moored to the mixer barge and gravel was wheeled directly into the mixer on wheelbarrows, a wheel of a little over 10 ft. The door of the cement house was within 5 ft. of the mixer. The sub-structure plant equipment consisted of four gravel barges, one mixer barge, two derrick barges, one compression barge, one pile driver, one sand hog house barge, two barges for miscellaneous use, and one tug.

No particular difficulty was encountered in erecting the steel, all of it being erected on falsework. The spans were erected in the following order: Nos. 7, 6, 5, 3, 2, 1, and 4. On account of a large sink hole on the north, it was impossible to get a track up to the bridge at that time, and it was necessary to bring in all material from the south, which caused some added difficulties in getting material. The government required an opening for river traffic during all stages of the construction, span 4 being left open till the lift span was completed.

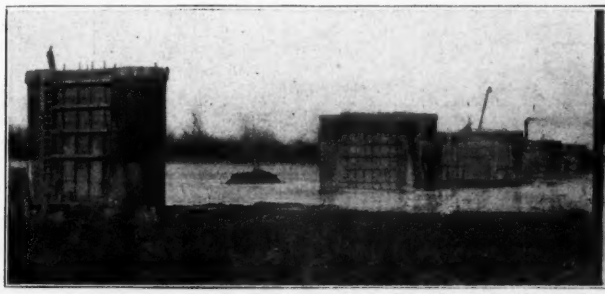
Spans No. 7, 6 and 5 were erected with a derrick car. The steel for spans No. 3, 2 and 1 was towed across the river and erected with a "mule" derrick on spools on about an eight foot gauge. After the lift span was erected, a stiff-legged derrick with an 80 ft. boom was set up on top of it, and the tower erected. When this work was finished, enough counterweights were placed to raise the span, the lift was raised to its highest position and river traffic turned under it. Span No. 4 had been left out to allow boats to pass, up to this time, and now No. 4 was erected with the derrick car.

Exceptionally fine weather was experienced and the erection work was not interfered with by either high winds or high water.

Operation of the Lift Span.

The lift span is operated by a motor connected to a common gear which operates the lifting mechanism at each end of the span. High voltage current, from a local power company, is stepped down by transformers at the bridge. In case the current or motor gives out, an auxiliary gasoline engine furnishes direct power for the operation. The lift span was designed by Waddell & Harrington under their patents. The span can be operated in 1½ minutes with the motor.

The bridge was designed in the office of the Chicago & North Western Ry., W. C. Armstrong bridge engineer, under the supervision of W. H. Finley, assistant chief engineer. H. M. Spahr, assistant engineer, was in charge of field work. The substructure work was done by the Missouri Valley Bridge & Iron Works, and the superstructure was erected by the Kelly-Atkinson Co.



Completed Piers, Bracing Still in Place.

Construction Plant. Pier Bracing Ready for Steel Cylinders.

Progress View Before Erection of Span 4.

The Atlantic Coast Line, it is said, will prepare plans and specifications for a system of overhead and underground crossings to be built at Savannah, Ga. It is also reported that this road will erect a new bridge over the Hillsborough river at Tampa, Fla.

Plans for the proposed Hopple St. viaduct at Cincinnati, O., have been approved by the engineers of the Baltimore & Ohio Southwestern, and are now in the hands of H. M. Waite, city engineer. Bids for the work will be asked soon.

The Boston & Albany has awarded a contract to the Lucius Engineering Co., Pittsburgh, Pa., at $150,000 for rebuilding the stone piers of its bridge across the Connecticut river at Springfield, Mass.

The Chicago & Northwestern, it is reported, has decided to rebuild its present passenger terminal at Milwaukee, Wis., doubling its size; build a new express warehouse and depot, and largely increase its freight house and trackage facilities instead of constructing an entirely new combined freight and passenger terminal on the lake front. The work as planned will cost about $750,000 as compared with a $2,000,000 expenditure under the original plan.

The Lehigh Valley, it is reported, is asking for bids on 1,500 tons of structural steel. This will be used in extending the street viaducts over the Hamburg canal strip, Buffalo, N. Y., and is preliminary, it is said, to the erection of a new passenger station.

The New York Central & Hudson River has let a contract for constructing a pumping station at Rome, N. Y.

The Norfolk & Western is erecting a new roundhouse at Columbus, Ohio.

The Northern Pacific, it is reported, has ordered 3,060 tons of bridge steel from the American Bridge Co.

The Oregon-Washington R. R. & Nav. Co. had awarded contracts for $156,000 to the Oregon Bridge & Construction Co., of Portland, for the construction of 12 bridges over Mutual river.

The contract for a union station, at Trent street, Spokane, to be used by the Oregon-Washington R. R. & Nav. Co. and the Chicago, Milwaukee & St. Paul, has been given to Grant, Smith & Co., Seattle, Wash.

The Southern Pacific will build a new passenger station at Los Angeles, Cal., which will cost approximately $700,000.

The Western Pacific has put into operation its new shop buildings at Sacramento, Cal.

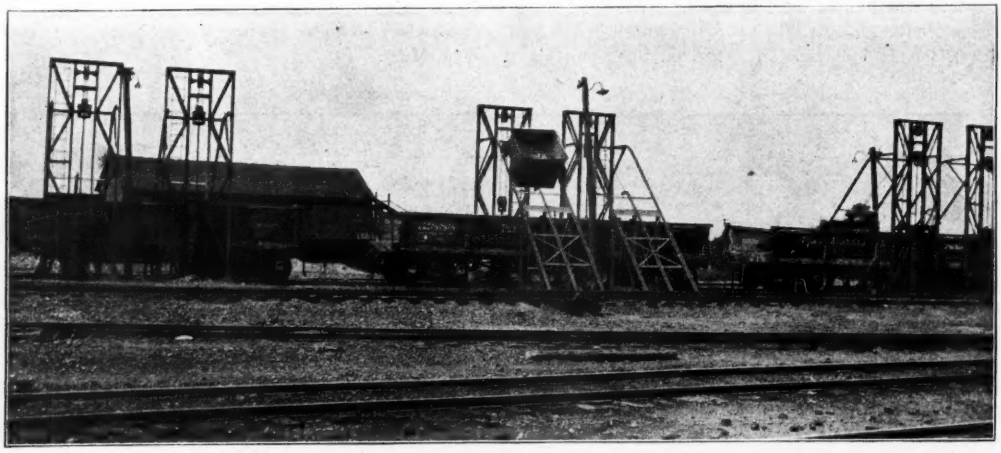
CINDER CONVEYOR, P. M. R. R.

Railway Engineering has long advocated the adoption of power machinery, wherever efficient machines are on the market, for the purpose of facilitating work, decreasing the necessity for common laborers, and decreasing the worries and cares of officials who have to handle present day labor.

On too many jobs, the time of the responsible head is taken up by endless bickerings, bargainings, persuasion and coercion of the laborers diverting his time and thought from the questions of paramount importance—effective planning and the introduction of economies in the work.

A properly constructed, efficient machine can be depended upon, if looked after by a competent man, to give service every working day in the year. Necessary light repairs can be made after working hours, and a general overhauling, when necessary, can usually be accomplished between Saturday night and Monday morning.

The capacity and cost of machine work can be figured quite closely, assuming similar or average conditions. Compare the erratic results of a gang of laborers. Ten laborers gross



Cinder Conveyors at Saginaw, Mich., P. M. R. R.

may mean five laborers net on Saturday afternoon, six laborers net Monday morning, with possibly the entire gang present for three or four days per week. And again, this gang of laborers, compared with a similar gang, may show astonishingly varying results. Uncertainity and unreliability are the common characteristics of a great deal of our railway labor today.

The point has frequently been brought up, that the interest and depreciation on a machine continues when the machine is not in use on account of slack work. But what of the gang of laborers doing the same kind of work, granted that they may be put to work "at something else?" The usual results in that case are well known. The laborers grasp the fact that there is a lull in their regular work, and that the work in hand is a fill-in; they are prone to consider that the work is only "to make them look busy." The result is that when you take a gang away from its regular job, (for instance, loading cinders at a cinder pit, unloading coal at a coaling station, etc.,) very little material benefit results. Furthermore, there is positive harm in the discipline of the gang. The men become lazy on the improvised work, and when returned to the regular work they are unwilling and indolent. When analyzed, the extra cost of labor, on regular work which fluctuates, would in general more than balance the fixed charges on a machine for the same purpose.

The foregoing discussion has had to do with the advantages of greater capacity, regularity, and dependability of an efficient machine, compared with hand labor.

An important further requirement of a machine is that it shall cheapen the work a sufficient amount to justify the initial investment. An automatic cinder conveyor for cinder pits, (one of a large number of similar installations) has recently been placed in service on the Pere Marquette R. R. at Saginaw, Mich., which combines efficiency with a first cost which is less, or at any rate, little more than the cost of the ordinary cinder pit where laborers handle the cinders.

The installation and operation of this machine (by air from the roundhouse reservoir, or by the compression of the locomotive at the pit), is very simple. As shown in the illustration, the pit required in the center of the track is 4 ft. 6 in. deep below bottom of rail, at the deepest point, with a length of 16½ ft. At each end is a section 2 ft. 8 in. deep below bottom of rail, with a length of 9 ft. The top of the cinder buckets, when lowered, are level with the floor of the central section of the pit, the pockets being 2 ft. wide and about 1 ft. 6 in. below the bottom of the pit. The entire pit is lined with concrete, as shown.

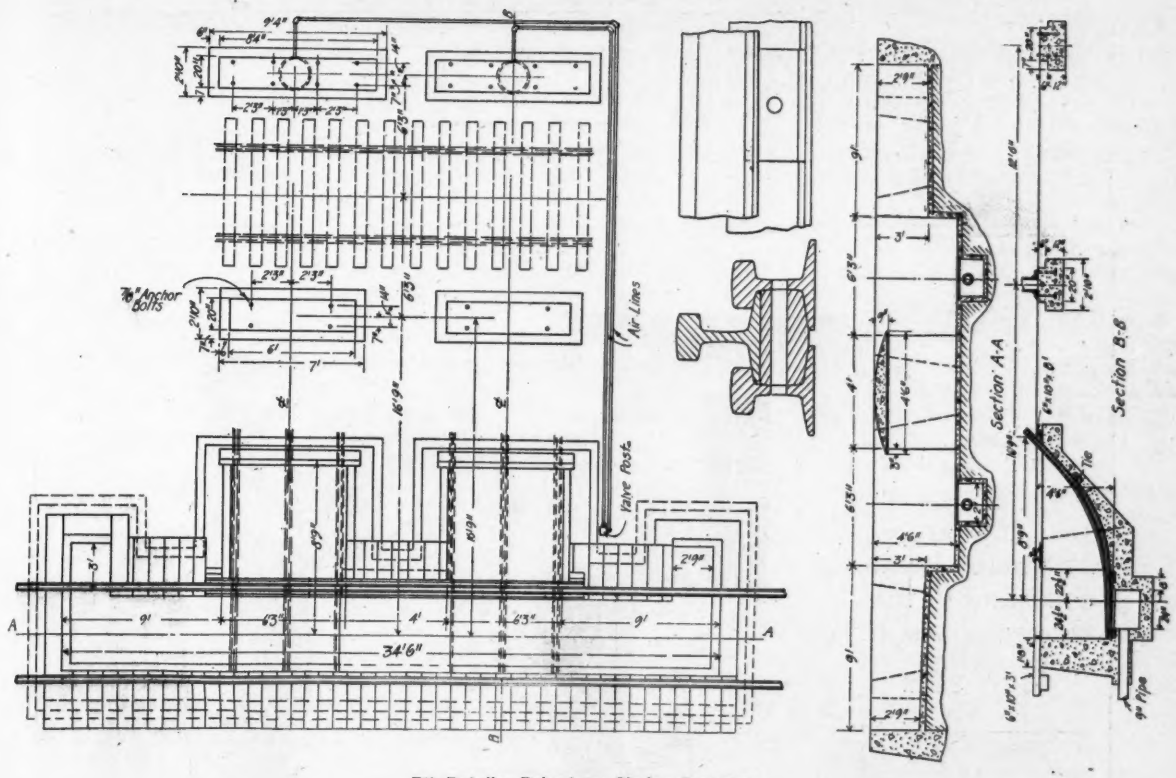
It is interesting to compare the amount of excavation required in this pit, with the amount required in what is considered a good pit for handling cinders by hand. The sketch herewith is used as a basis for arriving at the amount of excavation required. The excavation under the engine track will practically balance in the two types of pits. The yardage for the ordinary cinder pit, Figure A, will be about 510 cu. yds. For Figure B, the excavation at the side of the pit track would be about 5 cu. yds. Extra foundations would not run this higher than 10 cu. yds.

It is hardly necessary to describe the operation of the cinder buckets. They are raised or lowered by compressed air in the 16½ in. cylinder. The cinders are dumped out of the engine into the steel hopper buckets, wet down thoroughly, and then raised up the inclined tracks and dumped automatically into a gondola on the adjacent track.

The mechanism is very simple and can be undertsood and operated by a man of ordinary intelligence, or by anyone familiar with railway machinery. In case anything gets out of order, there is practically only one place to look for the trouble—in the air cylinder and valves.

Drainage for these automatic pits is much simpler than for the long hand labor pits. The excavations are not nearly so deep and therefore can frequently be connected to existing sewers, which solves the problem very simply. Where auxiliary apparatus is required to pump the water from the deeper cinder pit to a sewer, the cost of installation, operation and maintenance is appreciably higher. The area of the automatic pit is so much smaller than the other, that there is also a marked difference in the quantities of water accumulated by drifting snow, and by ice which melts later.

The cost of keeping the small pit clean is of course less



Pit Details, Robertson Cinder Conveyor.

than that of the large one. An objectionable feature of the old inclined railway track is the liability of a car breaking away and demolishing the end of the pit, and injuring the track. There is also with the hand pits the danger of the locomotive becoming stalled on slippery rails, or of the gondola freezing fast in the winter time and causing delay and trouble, especially as the track would be covered with ice. The automatic cinder pit, it will be noted, does away entirely with the depressed track for the gondola. This feature, allowing the empty gondolas to be spotted on level or slightly inclined track, is a great advantage. When a car has been loaded, it can easily be moved with a pinch bar, and an empty car spotted by hand.

The installation described herein was installed under the supervision of A. L. Grandy, chief engineer of the Pere Marquette R. R., by Wm. Robertson & Co. of Chicago. Wm. Robertson, formerly a master mechanic on the Grand Trunk Ry., invented and holds the patents on the inclined track type of cinder conveyor.

The Cleveland, Cincinnati, Chicago & St. Louis is said to have plans to build a $30,000 roundhouse at Mt. Carmel, Ill. This road has also begun construction on another roundhouse to be erected at East St. Louis, Ill. Other buildings, it is said, will be added later, the total expenditure to be about $300,000.

The Great Northern will build a new ore dock to replace No. 3 at Allouez Bay, Wis. The new structure will be of steel and much larger than the present one.

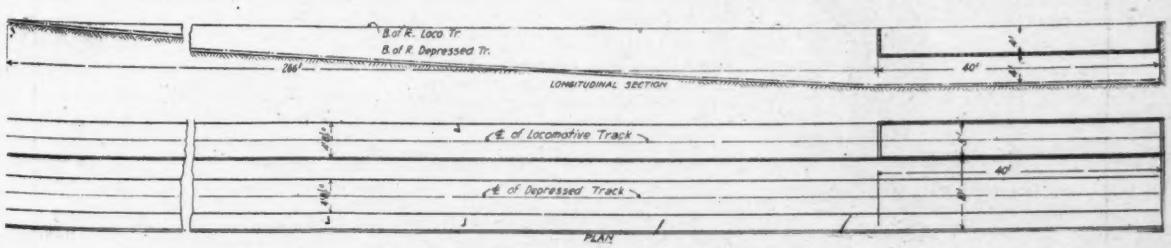
The Lake Shore & Michigan Southern, it is reported, is contemplating the construction of a round house at Ft. Wayne, Ind.

The Missouri & North Arkansas will expend $25,000 for a freight depot, engine house and additional trackage at Heber Springs, Ark.

Preliminary borings are being made for the new bridge which the New York, New Haven & Hartford is to build across the Thames river at New London, Conn. A two-track bridge will be built which can later be enlarged to four tracks.

The Black Mountain is now in operation between Black Mountain Junction, N. C., where a connection is made with the Carolina, Clinchfield & Ohio and Pensacola, 20.6 miles.

The Baltimore & Ohio has put into operation a new freight yard at Sand Patch, Pa., on the Connellsville division, 33 miles west of Cumberland, Md., and on the main line to Pittsburgh, Pa., and Chicago. It has a capacity of 200 cars and is used in the handling of westbound traffic. This road has also completed surveys for the new cut-off line which the road will build to establish a new connection between the Wheeling division and the Monongahela River line of the Monongahela division, in West Virginia, facilitating the movement of through traffic and the handling of coal from the extensive coal fields on that section of the system.



Typical Cinder Pit for Loading by Hand.

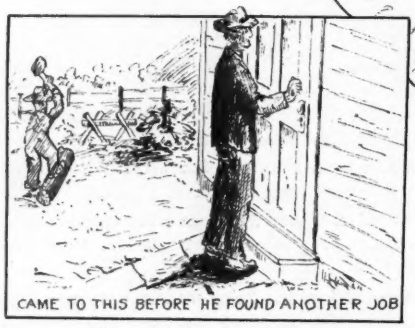
The Engineer's Distress

A. S. Gunn Editor

THE ENGINEER IN THE "MOVIES"

WHEN THE JOB IS COMPLETED, HE IS PRESENTED WITH A "NICE ROLL" OR MAYBE HE MARRIES THE PRESIDENTS DAUGHTER.

BUT SLIM



CAME TO THIS BEFORE HE FOUND ANOTHER JOB

AND

ONE SUMMER WENT BACK TO PITCHING HAY. WHO SAYS ONE CANT COME BACK? —

The RODMAN

by J.H.K.B. Engrs News.

"WHAT IS THAT, MOTHER?" "THE RODMAN, MY CHILD.
HIS FOOTSTEPS ARE WEARY, HIS ACCENTS ARE WILD;
HIS HAIR, HOW DISORDERED! HIS EYEBALLS HOW BLEAR!
AND SEE WHERE HIS NECKTIE HANGS UNDER HIS EAR."

ROD UP THERE! HOLD HER STEADY!! GO DOWN THE HILL!!!
7.8 CUT 2.2 — NO, BEGOSH, IT'S A FILL.
HALF THE ROADBED; 13+ THE SLOPE 1:1;
NO, IT'S 1½ THOUGH, AS SURE AS A GUN.
WELL THAT MAKES-LET'S SEE- OH! STICK HER IN THERE.
IT'LL DO. PEPHARS THE CONTRACTOR WILL SWEAR.
BUT NO DIFFERENCE: WE'RE THE BIG DOG IN THIS FIGHT
NO MATTER WHATS WRONG, JUST SWEAR IT'S ALL RIGHT.
A CONTRACTOR DONT KNOW A BEEFSTEAK FROM A BONE.
NOW PICK UP YOUR TOOLS, AND LETS PULL OUT FOR HOME."

AMERICAN RAILWAY BRIDGE AND BUILDING ASSOCIATION.

The twenty-third annual convention of the American Railway Bridge and Building Association will be held at the Windsor Hotel, Montreal, October 21-23, 1913. Committee reports will be presented on the subjects of water supply; track scales; equipment and tools for bridge gangs; concrete culverts and various kinds of pipe for culverts; heating, lighting and ventilation of roundhouses and shops; motor cars for bridge gangs; temporary structures for supporting tracks during construction of permanent work, sewers, etc.; concrete posts, poles and signs; snow fences; preservation of timber, cattle guards and fire-resisting coatings for timber.

The programme is as follows:

Tuesday, October 21.

Morning Session.

Call to order by the president at 10 o'clock.
Prayer.
Opening address by Wm. McNab, Principal Asst. Engr. Grand Trunk Ry.
Response.
Roll call (card registration system).
Reading of minutes of last meeting.
Report of executive committee.
Reports of secretary and treasurer.
Report of committees on membership, memoirs and relief.
Election of new members.
Recess to welcome new members and for the payment of dues.
President's address.

Afternoon Session.

Call to order at 2 o'clock.
Appointment of committees.
Reports of committees on subjects.
Discussion of reports.

Evening.

Meeting of executive committee at 7:30.

Wednesday, October 22.

Morning Session.

Call to order at 9 o'clock.
New business.
Unfinished business.
Reading of report of nominating committee.
Reports of committees and discussion thereof.

Afternoon Session.

Call to order at 2 o'clock.
Reading and discussion of committee reports.

Thursday, October 23.

Morning Session.

Call to order at 9 o'clock.
Unfinished business.
Election of officers.
Selection of meeting place for 1914.
Installation of officers.
Adjournment.

The Committee on Arrangements has planned a visit to the new St. Lawrence River bridge and to the shops of the St. Lawrence Bridge Company's plant, where the Quebec bridge is being fabricated. On Friday a trip will be made by special train to Ottawa.

The steady growth of the association during the past year indicates that this convention will be successful both in the character of its discussions and in the attendance of its members. Arrangements are now being made for those members living west of Chicago to go in a party on special cars leaving Chicago on Sunday afternoon. Members or guests desiring to go with this party should advise the secretary, C. A. Lichty, C. & N. W. Ry., Chicago, as soon as possible.

Personals

Operating.

Although we are publishing monthly in this column a practically complete report of all appointments of interest to our subscribers, it is probable that this information could be published earlier if each subscriber would make it his business to notify us of new appointments immediately. We request and we shall appreciate your assistance in this respect.

J. R. Hitchcock has been appointed superintendent of the *Atchison, Topeka & Santa Fe Ry.* at Los Angeles, vice J. B. Galivan.

P. B. Moss has been appointed assistant general manager of the *Beaver Dam R. R.* at Damascus, Va.

Harvey Derne, general manager of the *Big Sandy & Cumberland R. R.*, has moved his office from O'Keefe, W. Va., to Columbus, O.

As noted previously in these columns, James Paul Stevens has been appointed general superintendent of the *Chesapeake & Ohio Ry.* at Richmond, Va. He was born at Peru, Ind., December 28, 1885, and after receiving a common school education, entered

W. S. MARTIN, General Manager
Denver & Rio Grande R. R.

railway service as clerk to chief dispatcher in January, 1901, with the Chesapeake & Ohio Ry. In the latter part of 1902, and during 1903, he was copy operator in the dispatcher's office, and extra dispatcher at Richmond, Va. He was appointed assistant trainmaster at Covington, Ky., in January, and chief dispatcher at the same place in May, 1904. He was appointed assistant superintendent at Covington in February, 1907, and superintendent in January, 1908. He was appointed general superintendent of the Kentucky general division in May, 1910, and, as noted above, was appointed general superintendent of the Virginia general division at Richmond, Va., September 1, 1913.

Thos. H. Pindell has been appointed general superintendent of the *Chicago, Peoria & St. Louis Ry.*, office at Springfield, Ill. He succeeds W. C. Hurst, appointed general superintendent of the Pere Marquette R. R.

W. S. Martin, who has been appointed general manager of the *Denver & Rio Grande R. R.*, as already announced in these columns, was born Dec., 1863, at Keokuk, Ia. He entered railway service 1878, since which time he has been consecutively, to Feb. 2, 1880, clerk and telegraph operator, Missouri, Iowa & Nebraska at Keokuk, Ia.; Feb. 2, 1880, to July 1, 1880, assistant agent at Alexandria, Mo.; July 1, 1880, to June 1, 1881, agent same road same place; June 1, 1881, to July 5, 1881, with West-

ern Union Telegraph Company at Kansas City, Mo.; July 10, 1881, to Sept. 20, 1881, operator freight office, Wabash, St. Louis & Pacific Ry. at Keokuk, Ia.; Sept. 20, 1881, to Jan. 3, 1882, operator in dispatcher's office; Jan. 3, 1882, to Jan. 3, 1883, dispatcher, and Jan. 21, 1883, to Jan. 4, 1885, chief dispatcher same road at Centerville, Ia.; Feb. 14, 1885, to April 15, 1887, chief dispatcher Louisville, Evansville & St. Louis; April 15, 1887, to July 1, 1889, master transportation same road; July 1, 1889, to Nov. 15, 1889, trainmaster Nashville & Decatur division Louisville & Nashville; Nov. 15, 1889, to Oct. 1, 1891, assistant superintendent Nashville division Louisville & Nashville R. R. and Nashville, Florence & Sheffield R. R.; Oct. 1, 1891, to April 1, 1895, superintendent Owensboro & Nashville Ry.; April 1, 1895, to Jan. 1, 1898, superintendent Louisville division Louisville & Nashville Ry.; Jan. 1, 1898, to Sept. 1, 1900, superintendent Henderson & St. Louis division same road at Evansville, Ind.; Sept. 1, 1900, to April 1, 1902, general superintendent Denver & Rio Grande R. R.; June 1, 1902, to Dec. 31, 1902, superintendent Southern Ry. at East St. Louis, Ill., and Princeton, Ind.; Jan. 1, 1903, to May 31, 1907, general manager Mexican International R. R.; June 1, 1907, to Sept. 1, 1913, assistant general manager

H. S. BALLIETT, Asst. Terminal Manager
New York Central & Hudson River.

Denver & Rio Grande R. R at Denver. His appointment as general manager was effective Sept. 1.

C. M. McLain has been appointed superintendent of the *Estacado & Gulf Ry.*, office at Sweetwater, Tex.

H. S. Balliet, formerly signal engineer, exterior zone, has been appointed assistant terminal manager of the *New York Central & Hudson River R. R.*, office at New York City. D. B. Fleming, formerly assistant superintendent, has been appointed superintendent at Buffalo, N. Y., succeeding H. E. Brown.

N. A. Waldron has been appointed superintendent of the *Missouri, Kansas & Texas Ry.* at Parsons, Kan.

The office of J. J. Corcoran, superintendent of the *Pere Marquette R. R.*, has been moved from Detroit to Grand Rapids, Mich. H. O. Halsted has been appointed superintendent at Grand Rapids, Mich., succeeding H. C. Stewart.

W. T. Tyler, general manager of the *St. Louis & San Francisco R. R.*, has moved his office from Springfield to St. Louis Mo.

H. D. Earl has been appointed superintendent of the *St Louis South-Western Ry.* at Tyler, Tex.

H. B. Grimshaw, superintendent of the *Seaboard Air Line Ry.*, has been transferred from Savannah to Americus, Ga. T. W. McGaw, formerly trainmaster, has been appointed superintendent at Savannah, Ga.

Otis Weeks, formerly division engineer, has been appointed assistant superintendent of the *Southern Pacific Co.* at Ogden, Utah, succeeding L. Bauman, transferred.

J. E. Taussig has been appointed superintendent of transportation of the *Texas & Pacific Ry.* at Dallas, Tex., succeeding Page Harris.

W. H. Given has been appointed assistant general manager of the *Waterloo, Cedar Falls & Northern Ry.*, effective Sept. 2., office at Waterloo, Ia.

As previously announced in these columns, R. M. Johnson has been appointed superintendent of the *Western Maryland Ry.* at Baltimore, Ind. He first entered railway work with the Pere Marquette R. R., and was in charge of several important terminals, covering a period of 15 years. He was made trainmaster of the Saginaw division, and transferred in a similar capacity to the Detroit division, where he was employed till January 1, 1913. On the latter date he accepted a position as inspector of transportation on the Western Maryland Ry., which position he held till his appointment as superintendent, noted above.

Engineering

L. J. Allen, formerly engineer maintenance of way, has been appointed valuation engineer of the *Ann Arbor R. R.*

H. G. Field, formerly assistant bridge engineer, has been appointed bridge engineer of the *Baltimore & Ohio Chicago Terminal R. R.*, office at Chicago, Ill.

G. W. Abbott has been appointed division engineer of the *Boston & Albany R. R.* at Boston, Mass., succeeding E. A. Haskell, deceased.

E. F. Bargman has been appointed architect of the *Chicago & Alton Ry.*, office at Chicago, Ill.

W. R. Powrie has been appointed district engineer of the *Chicago, Wilwaukee & St. Paul Ry.* at Minneapolis, Minn., succeeding M. D. Rhame, retired. E. L. Sinclair is assistant district engineer, instead of resident engineer, as announced in the September issue of "Railway Engineering." F. B. Walker has been appointed assistant engineer at Lewiston, Mont., succeeding F. J. Herlihy.

Morris A. Zook has been appointed valuation engineer of the *Grand Trunk Ry.*, office at Buffalo, N. Y.

W. D. Stanton has been appointed assistant superintendent of the *Houston, East & West Texas Ry.* at Houston, Tex., succeeding to the duties of J. C. McVea, formerly division engineer.

J. C. Clifford, formerly roadmaster, has been appointed district engineer of the *Illinois Central R. R.*, northern lines, office at Chicago, Ill. C. E. Weaver, formerly roadmaster, has been appointed district engineer, southern lines, office at New Orleans, La. D. W. Thrower, formerly roadmaster, has been appointed assistant engineer maintenance of way, office at Chicago, Ill., succeeding A. F. Blaess, promoted.

R. A. Klock has been appointed general tie and timber agent of the *Intercolonial Ry.* at Moncton, N. B.

A. C. Jesson, formerly assistant engineer, has been appointed principal assistant engineer of the *International & Great Northern Ry.*, office at Houston, Tex. George M. Jarvis, formerly assistant engineer, has been appointed division engineer at Mart, Tex. A. McCormick, formerly assistant engineer, has been appointed division engineer at Palestine, Tex. R. F. Williams, formerly assistant engineer, has been appointed division engineer at San Antonio, Tex.

Frederick K. Bennett, recently appointed division engineer of the main line of the *Missouri, Kansas & Texas Ry.*, with headquarters at Muskogee, Okla., started railroad work in the spring of 1895 on the Lehigh Valley R. R. as rodman in the engineering department, and was in continuous service with that company until assistant engineer, charge of office and accounts; later, supervisor of tracks and division engineer. March, 1909, to June, 1910, he was resident engineer, Missouri Pacific Ry., on reconstruction in Kansas and Missouri; and June, 1911, to March, 1912, assistant engineer, office of engineer maintenance of way, Western district, at Kansas City, Mo. March, 1912, to June, 1913, he was assistant engineer, office of chief engineer, Missouri Pacific Ry.,

at St. Louis, Mo., his present appointment, noted above, taking effect in July.

W. G. Turner was recently appointed assistant engineer of the *Missouri Pacific Ry.* at St. Louis, Mo., in charge of grade crossing elimination.

H. S. Jones, formerly division engineer, has been appointed engineer of special work, *Mobile & Ohio R. R.*, office at Mobile, Ala. J. L. Cummings has been appointed division engineer at Murphysboro, Ill., succeeding W. B. Harris. A. H. Nichols, division engineer, has been transferred from Columbus to Meridian, Miss., succeeding H. J. Jones, promoted. E. J. Finnell has been appointed assistant division engineer at Murphysboro, Ill. B. F. Nicholls has been appointed assistant division engineer at Meridian, Miss.

D. K. Colburn, formerly assistant general manager, has been appointed engineer maintenance of way of *Morgan's Louisiana & Texas R. R.* at Houston, Tex.

A. W. Carpenter, formerly engineer of structures, exterior zone, *New York Central & Hudson River R. R.*, has been placed

M. A. ZOOK, Valuation Engineer
Grand Trunk Ry.

A. W. CARPENTER, Engr. in Charge of Valuation
New York Central & Hudson River

in charge of valuation work. He was born in Port Henry, N. Y., 1873, and graduated from Case School of Applied Science, Cleveland, O., in the civil engineering course. After graduation he was with the Osborn Co., civil engineers (now the Osborn Engineering Co.), of Cleveland, O., from 1895 to 1900, being employed variously on structural steel inspection work, bridge work (sub- and superstructure), field work and designing, cement testing, etc. In March, 1900 he accepted a position as assistant engineer in the engineering department of the N. Y. C. & H. R. R. R., being assigned to the examination of the strength of existing bridges. In 1902, on request, he was transferred to the position of supervisor of bridges and buildings, Pennsylvania division, with headquarters at Jersey Shore Junction, Pa., and in 1902 was promoted to the position of division engineer of the same division, and had charge of much construction work as well as maintenance during this period. In 1904 he accepted the position of bridge engineer on work outside the electric zone, headquarters New York City. In 1906 he was appointed engineer of structures, continuing in that position, with gradually increasing scope of duties, until his present appointment, effective August, 1913. He is a member of the American Society Civil Engineers, American Railway Engineering Association and representative member of the engineering department, N. Y. C. & H. R. R. R., in the American Society for Testing Materials.

H. M. Bassett, formerly assistant designing engineer, has been appointed special engineer of the *New York Central & Hudson River R. R.*, office at New York City, succeeding F. D. Bardwell.

H. T. Welty, formerly bridge engineer west side improvements, has been appointed engineer of structures, office New York City, succeeding A. W. Carpenter, promoted.

A. J. Himes, formerly engineer of grade elimination, has been appointed valuation engineer of the *New York, Chicago & St. Louis R. R.*, office at Cleveland, O.

G. H. Cumberland has been appointed division engineer of the *Oregon Short Line R. R.* at Pocatello, Ida. H. S. Osborn has been appointed division engineer, headquarters also at Pocatello, Idaho.

Robert Farnham, Jr., has been appointed assistant engineer of bridges and buildings of the *Pennsylvania R. R.*, office at Philadelphia, Pa.

As previously noted in these columns, W. D. Wiggins has been appointed valuation engineer of the *Pennsylvania Lines West*, office at Pittsburgh, Pa. He entered the service of this railway in the engineering department at Logansport, Ind., in 1895, and has held various positions in both the engineering and operating departments. Previous to his recent appointment, which was effective July 1, he was superintendent of the Peoria division of the Vandalia R. R.

The office of W. J. Long, division engineer of the *Pere Marquette R. R.*, has been moved from Detroit to Grand Rapids, Mich.

W. W. Morrison has been appointed engineer maintenance of way of the *Pittsburgh & Shawmut R. R.* at Kittanning, Pa.

The engineering department offices of the *St. Louis & San Francisco R. R.* have been moved from Springfield, the offices of the following men being moved to St. Louis, Mo.: V. K. Hendricks, assistant chief engineer; R. E. Miller, engineer of bridges; R. C. Stephens, architect; P. J. Neff, assistant engineer; G. H. Brookings, assistant engineer, and O. C. Steinmeyer, general treating inspector.

I. H. Farmer has been appointed right of way engineer of the *Seaboard Air Line Ry.*, office at Portsmouth, Va., succeeding G. H. Earp, promoted.

R. D. Garner has been appointed engineer of construction of the *Southern New England Ry.*, office at Montreal, Que.

L. Beauman, formerly assistant superintendent, has been appointed division engineer of the *Southern Pacific Co.*, at Stockton, Cal., succeeding O. Weeks, transferred. W. H. Phelps has been appointed assistant division engineer at San Francisco, Cal.

J. E. Danes has been appointed engineer maintenance of way of the *Wabash R. R.*, office at Decatur, Ill., succeeding F. V. Marshall.

G. H. Ballantyne has been appointed assistant engineer of the *Western Pacific Ry.* at Elko, Nev., succeeding C. Duckworth.

A. F. Blaess has been appointed district engineer of the *Yazoo & Mississippi Valley Ry.*, office at Memphis, Tenn. He graduated from the University of Michigan, 1895, in civil engineering course. He was employed as chainman and rodman on engineering corps, making preliminary and location survey for the Detroit & Mackinac Ry., 1895 and 1896, and entered the service of the Illinois Central R. R. as track apprentice in 1897; worked as track apprentice about three months, and was transferred to the engineering department as rodman. He was employed in various positions of the engineering department, ranking from rodman to assistant engineer in the construction and maintenance departments until 1902, when he was appointed road supervisor, holding this position until 1905, when he was appointed roadmaster. In 1911 he was appointed assistant engineer maintenance of way, of the Illinois Central and Yazoo & Mississippi Valley, and served in this latter capacity until his recent appointment as district engineer of the Yazoo & Mississippi Valley Ry., effective August 25.

Bridges and Buildings.

F. K. Irwin has been appointed superintendent of bridges and buildings of the *Boston & Maine R. R.*, office at Boston, Mass. He graduated from Stevens Institute in 1883, and entered the

F. K. IRWIN, Supt. Bridges and Buildings Boston & Maine R. R.

service of the Wisconsin Central R. R. in 1884 as mechanical draftsman, later being promoted to mechanical engineer. In 1899 he entered the service of the Union Pacific R. R. as assistant engineer in charge of shop construction. He entered the service of the New York, New Haven & Hartford R. R. as engineer in charge of the design and construction of the Readville shops, and was appointed superintendent of bridges and buildings in 1908. In 1913 he was appointed special engineer in charge of design and construction of the Billerica shops, B. & M. R. R., which position he held till his appointment as superintendent of bridges and buildings, effective September 1.

R. McD. Smith has been appointed master carpenter of the Southern division of the *Chicago & Alton Ry.*, office at Bloomington, Ill., succeeding W. E. Pitcher. Mr. Smith has been in the employ of the Alton for 15 years.

M. M. Myers has been appointed assistant master carpenter of the *Chicago, Burlington & Quincy R. R.* at Greybull, Wyo.

P. Aagaard, formerly supervisor of bridges and buildings, has been appointed superintendent of buildings of the *Illinois Central R. R.*, office at Chicago, Ill. O. M. Suter has been appointed supervisor of bridges and buildings at Chicago, succeeding Mr. Aagaard.

J. E. Rosenbalm has been appointed general foreman of bridges and buildings of the *St. Louis & San Francisco R. R.* at Springfield, Mo., succeeding G. W. Turner.

Twenty Years Ago This Month

Up to October, there had occurred in the calendar year of 1893, twenty-three great railway wrecks, resulting in the death of 198 persons and in injuries to 543. This record was used in the press as strong argument for block signals, at that time generally considered too expensive.

In the latter part of 1893, *The Official Railway List*, now *The Monthly Official Railway List*, was subjected to a bitter public attack by a competitor and was defended most effectively in the October, 1893, issue of the *Railway Master Mechanic*.

[Editors Note:—It seems that in 1893, as now, the competitor wishing to attack the *List* did so by showing the omission of certain logging and private roads in its compilation and also by calling attention to the fact that certain roads of similar nature were included. In other words, the publishers are charged with error if they do include this class of roads, and again if they do not. This is due to the fact that including or excluding roads of dubious importance or condition is a matter for the judgment of the editors. The *Red List* was then, and still is, the accepted official reference of its kind. "Out of his own mouth shall he be condemned."]

The "Busk tunnel" on the Colorado Midland, one of the greatest engineering tasks west of the Mississippi river, was completed and placed in service.

An official order of the New York, New Haven & Hartford issued to the heads of all departments required the immediate discharge of all relatives of the said department heads.

The contract for boring the Simplon tunnel at an estimated cost of $10,000,000 was let during the month. One of the conditions was a guarantee of completion in five and one-half years. The tunnel was to be built with a provision for widening and double tracking later.

President Miller, of the Chicago, Milwaukee & St. Paul, ordered all salaries, effected by the 10 per cent cut of two months previous, restored.

E. H. McHenry was appointed chief engineer of the Northern Pacific to succeed J. W. Kendricks.

D. D. Carothers was appointed engineer maintenance of way of the Baltimore & Ohio Southwestern.

The Alexandria & Western will have about 20 miles of track ready for operation in a month and it is reported that an extension will be made via Fullerton to De Ridder or possibly direct to Leesville.

The Altus, Roswell & Pacific, it is reported, will resume construction work on a line from Altus, Okla., to Roswell, N. M. About 100 miles of grade in Texas are reported to have been completed.

The Butte, Wisdom & Pacific, it is reported, will begin construction work about October 1 on a line from Divide, Mont., up the Big Hole river in Silverbow, Beaverhead and Deerlodge counties, Mont.

The Birmingham & Tidewater will be constructed from Birmingham to the Warrior river, a distance of 16 miles.

The Butte, Wisdom & Pacific which is now making permanent survey for its proposed line will undertake construction on the first section from Divide to Elkhorn, Mont., 24 miles, this fall. It is planned to complete the heavy rock work this fall and winter. Three tunnels will be required.

CONCRETE DEPARTMENT

Concrete and the "Bridge Beautiful."

THE DESCRIPTION of the Continental Ave. Bridge on another page illustrates very forcibly the great possibilities of concrete as a material for structures with artistic lines.

One of the teachings of esthetics is that structures should *not* be made to *appear* as *something* which they are *not* and in general the best results are obtainable if this rule is followed. In many cases, however, the conditions and circumstances are such that we must depart from this teaching or be greeted by some ugly structure where all else is of an artistic nature. Such was the condition at Forest Hills, the plate girder bridge having been built sometime before the scheme of architectural treatment of the town was evolved. To have this comparatively new steel structure replaced by one in keeping with the surroundings would have been a very costly proceeding accompanied by the usual inconvenience caused by such operations.

The manner of solving this problem at the least expense by the use of a concrete arch screen is an object lesson for the architect and engineer interested in bridge work. There are many steel track elevation bridges in our large cities which sooner or later will have to be modified in appearance in order to comply with the requirements of the "City Beautiful Plans" or park and boulevard projects which are slowly being evolved and when that time comes concrete will be material with which the transformation will be brought about, no doubt in many cases in a manner similar to the one described.

Jarring of Concrete After Placing.

THE IDEA that all discretion and care can be thrown to the winds after concrete has been placed, cannot be too severely condemned. All the care exercised in selecting good material, water and mixing, can be rendered worthless by not protecting concrete, after it is placed, from loads, until the concrete has had time to harden.

Concrete after being put in place should not be subjected to loads, jars or strain until it has thoroughly hardened, for if disturbed while setting the bond on steel will be destroyed and cracks will be formed which never close up and consequently structure is weakened greatly.

The jarring of forms or projecting ends of reinforcing bars will weaken the bond for some distance back from the construction point. The practice of guying the hoisting tower to the forms should be discontinued, since there is always a certain amount of strain and jar caused by the swaying of the tower. The concrete plant should be laid out and the work so planned as to do away with the necessity of having to wheel concrete over that previously placed. The extra loads coming on the forms in this way are often sufficient to cause considerable deflection in forms and consequent cracks in the concrete. The same thing is true if form lumber or other materials are placed on new concrete, even if the forms are still in place under the concrete. The fact that workmen have little trouble in keeping off of surfaces with a troweled finish while green, is sufficient evidence that they can, if properly disciplined, give ordinary concrete surfaces a chance to take final set before subjecting them to loads and shocks.

Inspection Trips for Draftsmen.

The C. M. & St. P. Ry. recently conducted an inspection trip for a picked party of its engineering draftsmen over the second track and grade revision work on the C. & C. B. division in Iowa. This work includes many large concrete structures of more than ordinary interest and the trip afforded an excellent opportunity for the designers to view the actual construction of their designs. If such trips are made comparatively often the railroad cannot help but profit by the experience gained by its employes. In order to derive the greatest benefit for all concerned these inspection tours should be made at such intervals as to keep the designers entirely familiar with the actual methods employed on the various kinds of work.

It is a fact that in many cases decidedly uneconomical designs for concrete structures are made because of ignorance on the part of the designer of the most desirable method of construction and plant layout. In railroad work, especially on second track and grade revision work, the methods of construction have a vital influence on the design and for this reason the designer should be thoroughly acquainted with the details of construction. The organization of the engineering departments of large railroads is such as to preclude the possibility of having the designer superintend or inspect the construction of structures built from his plans. This without doubt is the best method of acquainting an engineer with the weak points of his design viewed from a construction standpoint. Since this method is impossible the nearest approach to it which can be conveniently made is the conducting of frequent inspection trips.

On such occasions many a designer finds that details which he had reason to believe were the very best are not at all suited to the conditions governing the construction and are therefore unnecessarily increasing the cost of the work. It is therefore easy to see that in general a designer with construction experience is much more valuable than the man who has done nothing but turn out plans without seeing how they were carried out in actual construction. Since it is impossible to organize an entire force of engineering draftsmen, all of whom have had this experience, it is the duty of the railroad company to educate its employes in this line so far as possible, for the mutual benefit of all concerned.

The highest reinforced concrete building in America is said to be a grain elevator, built by J. S. Metcalf Co., Montreal, for the Harbor Commissioners of Montreal. This structure is 220 ft. 9 in. high from base of rail to top of concrete of the cupola. The building is 456 ft. 8 in. long by 190 ft. wide, the cupola at one end being about 300 ft. long.

CURRENT PRICES—CONCRETE MATERIALS.

Portland Cement—The demand is very active in all parts of the country and the stock on hand is low. Tendency seems to be toward a maintenance of the present prices. Prices at various points are as follows: New York $1.58; Boston, $1.72; Pittsburgh, $1.58; Cleveland, $1.76; Detroit, $1.74; Chicago, $1.65; Dixon, Ill., $1.50; Syracuse, Ind., $1.55; Baybridge, O., $1.55; Minneapolis and St. Paul, $1.85; Seattle, $2.25.

Crushed Stone—New York: 1½-in. stone, 85c to 95c per cu. yd.; ¾-in. stone, 90c to $1 in full cargo lots at docks. Chicago: 1½-in. stone, $1.15 per cu. yd.; ¾-in stone, $1.15, f. o. b. Seattle: 1½-in. stone, $1.45 per cu. yd., f. o. b., carload lots.

Gravel—New York: 85c to 95c per cu. yd. in full cargo lots at the docks. Chicago, $1.15 per cu. yd., f. o. b. Seattle, 75c per cu. yd., f. o. b., carload lots.

Sand—New York: 50c per cu. yd., full cargo lots at docks. Chicago: 80c per cu. yd., f. o. b. Seattle: 75c per cu. yd., f. o. b.

Reinforcing Bars—Pittsburgh base quotations on mill shipments, f. o. b., are 1.45c per lb.; on large orders quotations of 1.40c can be obtained. At Chicago quotations on mill shipment are from 1.58c to 1.63c, f. o. b. base, and at Seattle 2.20c per lb. Shipments from stock are being made at the following prices: Pittsburgh, 1.90c, f. o. b.; New York, 2.20c, f. o. b.; Chicago, 2.05c, f. o. b.; Seattle, 2.75c, f. o. b. for base bars, and the prevailing extras for bars under ¾ in. or base. At present business is dull, but there is no indication of a drop in price.

Metal Clips for Supporting Bars—$7.25 to $8 per 1,000, f. o. b. Chicago.

For a majority of the prices given above we are indebted to the Universal Portland Cement Co., Sandusky Cement Co., F. T. Crowe & Co., Seattle, and the Concrete Steel Co., Chicago and New York. At present our current price section is not as complete as we wish to make it. We hope, however, within a few months to be able to enlist the aid of dealers in various parts of the country, by showing them that this is not an experiment but a permanent part of our concrete section, which we aim to have known as the best in the field.

Concrete Railroad Bridges of Three Different Types

A Description of a Plate Girder Bridge with Concrete Portal; a Solid Spandrel Arch Bridge, and an Overhead Highway Bridge of Flat Slab Construction.

By A. M. Wolf, C. E.

Introduction.

The purpose of this article is to give an indication of adaptability of concrete to bridges of widely different types which best suit the conditions at hand. The use of concrete in the artistic treatment of bridges is becoming widespread and the description of how an ugly plate girder structure was transformed into one of beauty by the application of concrete should be of interest to the architect and engineer. The arch bridge described is an excellent example of the massive beauty possessed by a plain but symmetrical structure of this type. The use of flat slab construction for overhead highway bridges is comparatively recent and the adaptability of such construction to locations where the head-room is limited is clearly shown in the description of Lafayette street bridge, which has a deck thickness of only 28 inches at the crown of roadway, for a 36 feet 6 inches span.

Continental Avenue Bridge, Forest Hills, N. Y., L. I. R. R.

The elimination of grade crossings on the Long Island Railroad has been in progress about ten years. During this period a great number of bridges have been erected within the New York city limits. The advantages of continuous ballasted tracks over bridges, in making a better riding track, a more nearly noiseless structure and one free from the nuisance of water and waste dripping to street below, were recognized early in the prosecution of this work. Reinforced concrete slabs were, therefore, employed for the floors of both deck and through girder bridges. Among the structures thus treated is the bridge carrying four main line tracks over Continental avenue, at Forest Hills.

This structure consists of deck plate girder spans carried on steel columns at the curb lines and plain concrete abutments at the street lines. The roadway spans are 40 feet, while those over sidewalks are 20 feet. The clearance over roadway at the center line of street is 14 feet.

The bridge, as originally built, presented the usual plain appearance of a plate girder bridge with ballasted floor, having simple rectangular outlines, relieved in the usual manner by curved brackets at the tops of the columns. Upon the formulation of a general decorative scheme for the structures proposed for the Sage Foundation Homes Co., at Forest Hills Gardens, the simple, plain bridge was considered by the supervising architect, Grosvenor Atterbury, to be too severe in its outline and general appearance and consequently unharmonious with the surroundings. To relieve this situation the scheme of architectural decoration shown in the accompanying illustration was devised.

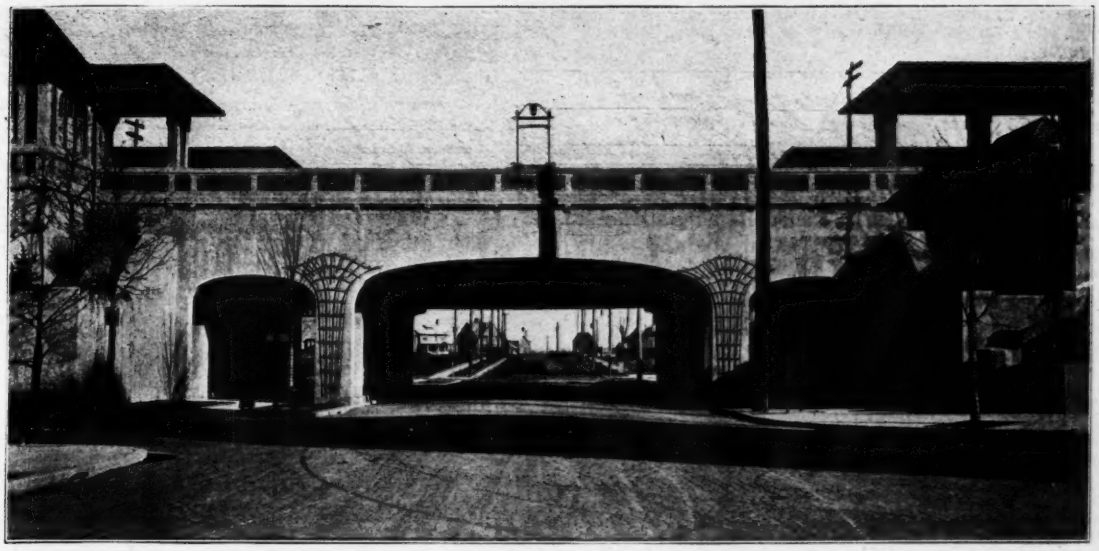
Forest Hills, which in the past two years has sprung into world-wide prominence because of the fact that it is the site of the suburban housing experiment provided for by the Russell Sage Foundation, is located on the hills of Long Island only "fifteen minutes from Broadway." The fundamental idea of this undertaking is to demonstrate that architectural beauty and good construction are not impossible if such developments are to be profitable. Practically all the homes and buildings, including those in "Station Square," which is a most beautiful spot, are of concrete in some form or other.

In order to have the Continental avenue bridge harmonize with its surroundings a treatment with concrete was necessary. This was accomplished by building a false arched screen with three arches of small rise and a passenger platform support, in front of the girders, the surface finish of which agreed in color and texture with that of other adjacent structures. The plane of the faces of the arches is 13 feet from the center line of the outergirders and the rise of the arches is such as expose a goodly portion of the girders below the intrados of the arch. This, however, does not spoil the effect of the arched portal, the high light on the arch faces making them so pronounced that the horizontal line of steel work, 13 feet back from the face, is hardly noticeable a short distance away.

In the stucco facing of the arch a considerable percentage of broken bits of red roofing tile was incorporated, which produces a warm pinkish tone distinctly more pleasing to the eye than the cold gray tinge of ordinary concrete. A much smaller percentage of the broken tile in ordinary work would be sufficient to relieve the dead gray surface of concrete made of the usual constituents. The proportions used in this work were as follows:

One cubic foot of cement, one cubic foot of sand, one-third cubic foot of ¼-inch gravel, one-third cubic foot of ¼-inch broken tile, one and one-half per cent by weight of black oxide.

The projecting parapet with the small brackets under the concrete posts in the hand rail with brick panels and concrete top rail adds much to the beauty of this structure which presents an unique solution of the problem of converting an ugly bridge into one of graceful and harmonious outline.



Continental Ave. Bridge, Forest Hills, N. Y., L. I. R. R.

We are indebted to Mr. J. R. Savage, chief engineer Long Island R. R., for photograph and data used in this article.

Concrete Arch Bridge Over Schuylkill River at Douglassville, Pa., Pennsylvania R. R.

In line with its policy to replace steel truss bridges, which have become too light for the heavy equipment now in use, with the concrete arch bridges, the Pennsylvania R. R. recently (1912) completed a single track concrete arch bridge over the Schuylkill river at Douglassville, Pa., on the Schuylkill division. This structure, composed of eleven 51-foot span, solid spandrel, skew arches, with 12-foot rise, is 15 feet wide under coping and 650 feet long. The bridge, which forms one-half of the proposed double track structure, was built alongside the old steel truss bridge, the center line of which was 17 feet 4¼ inches upstream from the center line of the new structure, without interrupting traffic. The piers of the new bridge were built to such length as provide a connection for the extension of the arches when a second track is required. The base of rail on the bridge which extends over the river bottoms is about 32 feet above normal water level, while the high water level is 5 feet above springing line or 12 feet 6 inches below the base of rail. The piers are set on a 60 degree skew with the center line of bridge.

The bridge, though very plain and without decoration, presents a good appearance on account of its symmetry and size.

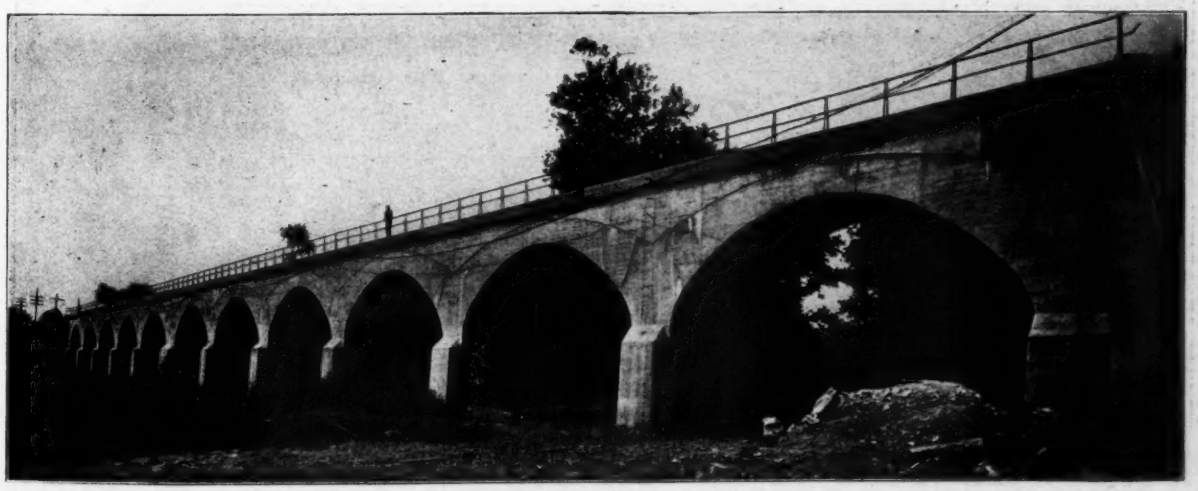
Design.

The loadings used in design were dead load of structure and fill and the standard live load used by this company, namely, two 214-ton locomotives with 35-ton axle loads and a corresponding uniform following load.

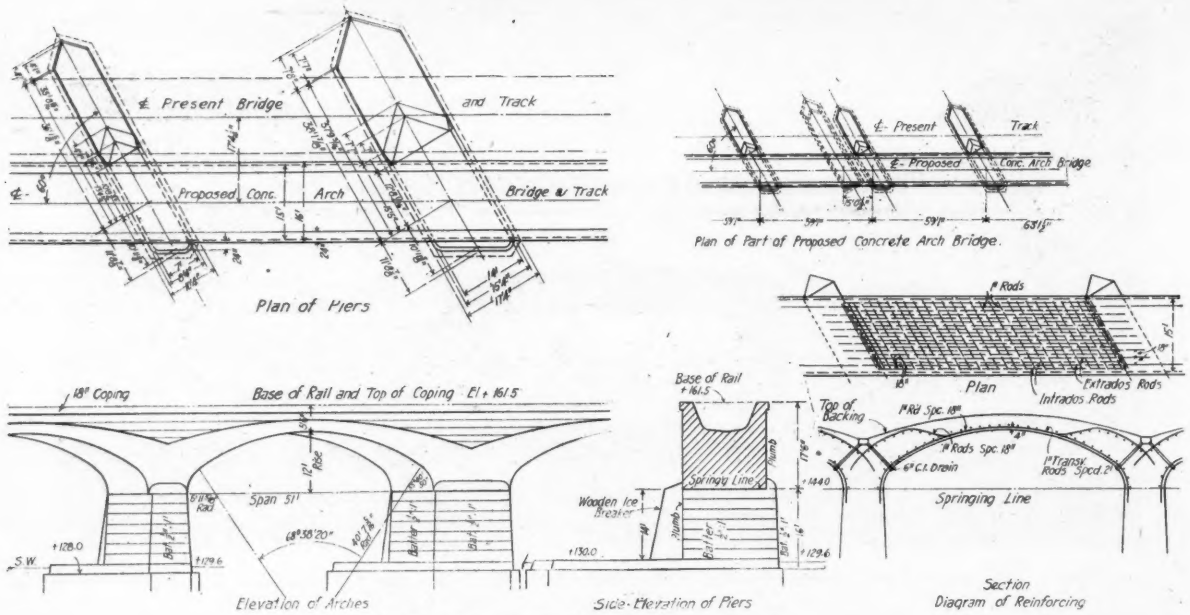
The piers are of plain concrete resting on solid rock foundation. Intermediate piers are 7 feet thick at the springing line of arches with a side batter of ½ inch to 1 foot down to the top of footing courses, which are 16 feet below springing line.

The footing courses for the piers are 10 feet 4 inches wide and were built to the full length required for a double track structure. The neatwork of piers was built only long enough for a single track structure and a wooden ice-breaker erected against the vertical upstream end of the pier. An abutment pier 14 feet wide at the top was placed at the end of the fifth span from the left-hand end of the bridge in order to have the structure separated into two independent sections as far as thrust is concerned.

The abutments of plain concrete with gravity wing walls were built around the old abutments, thereby saving considerable concrete.



Schuylkill River Bridge, Douglassville, Pa., Penn. R. R.



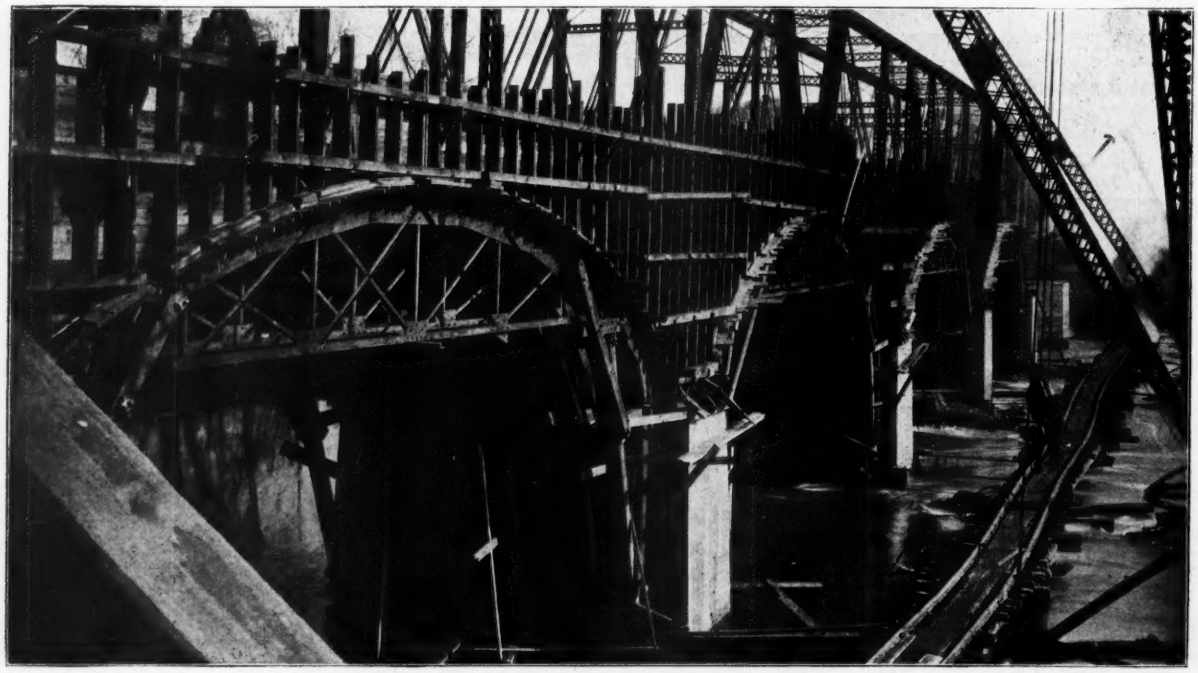
Details of Schuylkill River Bridge, Penn. R. R.

The arch rings, with a clear span of 51 feet, are circular segemental with an intradosal radius of 40 feet 7 5/16 inches except for a small portion just above the spring, which has a radius of 5 feet 11 5/8 inches. This gives the arch rings a much better appearance and really makes them three-centered. The arch rings are 3 feet thick at the crown and 10 feet thick vertically above the springing line over the center lines of piers. The reinforcement consists of 1 inch square bars 18 inch centers, longitudinally, bent to fit the curve of the intrados with 4 inches clear between face and bars. These bars extend well into the piers, as shown in the section. Longitudinal bars of same size and spacing in the extrados of arch ring bend down into the plane of the intradosal bars at about the quarter point of the span. Transverse reinforcement is furnished by 1-inch bars 2-foot centers, just above the intradosal bars and just below the extradosal bars. Two cast iron drain pipes 6 inches in diameter are placed over each pier to drain the fill over the arch ring.

The spandrel walls are of the plain concrete, gravity type, with a width at the top of coping of 2 feet, the coping projecting 6 inches beyond the face of spandrels which are vertical. The top of coping is on line with the base of rail and 5 feet 6 inches above the crown of the arches. A two-pipe iron handrail is placed on the copings.

Concrete.

The arch rings and spandrels were constructed of 1:2:4 concrete, while the piers and abutments were of a 1:2½:5 mixture.



Construction View, Schuylkill River Bridge, Penn. R. R.

Construction.

The centers for the arches consisted of eight light steel trusses with curved top chords, supported by vertical and inclined posts at the ends, resting on frames supported on the footing courses of the piers which were built up to the springing line before the arches were started. Upon the top chords of these trusses was placed heavy tongue-and-groove lagging as forms for the soffit of arches. The outside wall forms for spandrel were then erected, reinforcement placed and concreting begun.

The concrete was mixed on shore, transported to the place of concreting by construction trains on a temporary construction track on the downstream side of the bridge built upon cribbing so as to be just above water. The buckets containing the concrete were then hoisted into place by stiff-leg derricks, one being stationed at the mid-span of each arch. The arches were cast in five sections as shown by the radial grooves on the ring faces in the illustration.

The illustration shown gives a clear idea of the type of centering and forms, also the construction layout.

Quantities.

The total amount of concrete used in the construction of this bridge was 6,500 cubic yards, while the reinforcing steel required amounted to 44 tons.

We are indebted to Mr. A. C. Shand, chief engineer of the Eastern Pennsylvania division, and J. W. Lee, Jr., for photographs, plans and data used in this article.

Overhead Highway Bridge of Flat Slab Construction.

The Lafayette street bridge, St. Paul, Minn., over the M., St. P. & S. Ste. M., R. R., is a flat slab structure of the Turner Mushroom type carried on reinforced concrete abutments and six intermediate reinforced concrete columns. The bridge is 66 feet wide over all, with a 42-foot roadway, with two street car tracks and two 12-foot sidewalks. The structure is 76 feet 6 inches long between abutments on one side and 91 feet 9 inches long on the other, one abutment being on a 13 degree skew. The minimum clearance between base of rail and bottom of slab is 22 feet.

Design.

The bridge was designed for the dead load of structure and a live load of 150 pounds per square foot and heavy street car loading.

The abutments are reinforced concrete cantilever walls with vertical faces and battered backs. The top width of walls is 2 feet while the thickness at the base varies with the height, being 3 feet 6 inches for the maximum height of wall (31 feet). The width of base is 9 feet for the maximum height or about 0.27 of the height, which is much narrower than the usual practice. The wall is considered as held at the top by the deck slab to which it is anchored by bending the vertical bars into the slab, which accounts for narrow base. Sections of abutments shown herewith show the details of reinforcement. The wing walls at one side are cantilever walls and the others counterfort walls.

Lafayette St. Bridge, St. Paul, Minn.

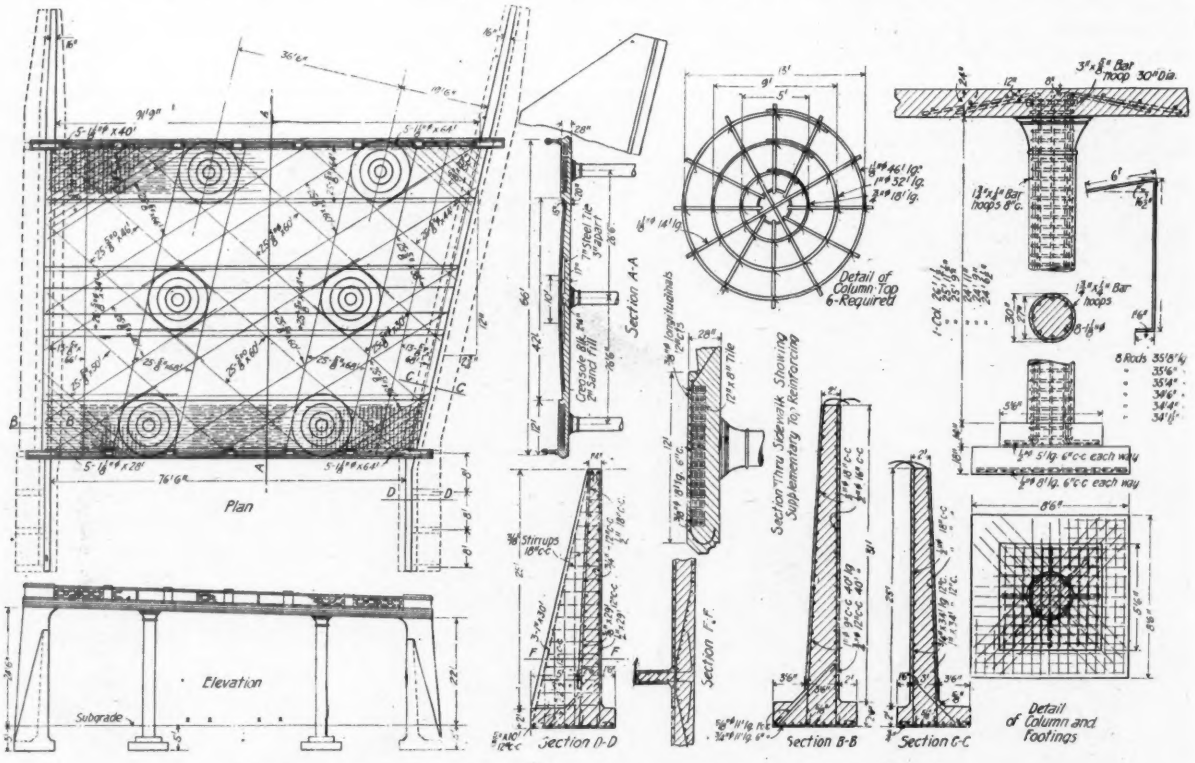
The six intermediate columns supporting the slab are placed in two rows parallel with the abutment which is set on a 13 degree skew. The center line of the first row of columns is 19 feet 6 inches from the face of the skew abutment and the center line of the next row 36 feet 6 inches beyond. The transverse spacing of columns is 26 feet 6 inches, the sidewalk cantilevering 6 feet 6 inches beyond the outer columns. The columns rest on two-course footings 8 feet 6 inches square and 2 feet 8 inches deep, reinforced as shown in detail plans. The columns are 30 inches in diameter and from 24 feet 6 inches to 26 feet long, reinforced with eight 1⅛-inch diavertical bars and 1¾ x ¼-inch bar hoops 6-inch centers. The bottom ends of vertical bars are bent at right angles at the top of the bottom footing course and at the top are bent into the slab for a distance of 6 feet. Upon the upper, bent ends of the column bars are placed three circular bars as shown in the accompanying detail to form a support for the slab bars, which extend over the column top in four directions. The concrete columns have flaring capitals about 50 inches in diameter at the top.

The roadway slab is 24 inches thick at the crown of road and reduces to 15 inches where the creosoted block pavement

stops at the gutter. Standard 7-inch Carnegie steel ties are embedded in the concrete to carry the street railway tracks. The portions of the slab forming sidewalks have a total depth of 28 inches with 12 x 8-inch tile set 4 inches below the surface to form continuous conduits for wires, etc. Over the columns the tile are laid flat and on edge at mid-span.

The reinforcement consists of multiple-way bands 13 feet wide, of 25-⅝-inch diameter bars each, regardless of length of spans, which does not seem quite rational. The bars over columns are held up in the top of the slab by the head frames formed by the bent column bars. Where it is necessary to lap bars the splices are made over the columns.

The showing edge of the sidewalk slab is beveled and molded,



Details, Lafayette St. Bridge, St. Paul, Minn., over M., St. P. & S Ste. M. R. R.

thereby presenting a better appearance than if left vertical. A cast concrete handrail of pleasing design between broad solid concrete posts is placed at the outside of the sidewalk slab This handrail was cast in sections on the ground and erected later.

This structure is a good example of the adaptability of flat slab construction to overhead highway bridges where the clearances are limited. The bridge was designed by Mr. C. A. P. Turner, to whom we are indebted for plans and photographs used in this article, for the M., St. P. & S. Ste. M. R. R., while the late Mr. Thomas Greene was chief engineer.

UNIVERSAL BULLETIN.

The September bulletin of the Universal Portland Cement Co. contains descriptions and illustrations of a great variety of concrete structures, namely, two large flat slab concrete buildings, the new Soo Line freight terminal at Chicago, two reinforced concrete trestles, a small concrete bridge and a concrete road. The most interesting articles are those descriptive of the Ford Motor Co.'s Service Bldg. at Chicago, a flat slab building designed under the Akme System by the Condron Co., Chicago, and the Soo Line terminal, a flat slab structure, covering eleven city blocks, designed for railroad loading by the Concrete Steel Products Co. of Chicago.

If you desire this bulletin monthly, send your request to *Railway Engineering*, Manhattan Bldg., Chicago.

GERMAN REGULATIONS FOR REINFORCED CONCRETE.

It will no doubt be of interest to learn that on April 22, 1913, the Prussian Minister of Public Works announced that in the future the permissible tensile stress in steel reinforcement will be increased from 1,000 kg/cm² (14,200 lbs per sq. in.) to 1,200 kg/cm² (17,040 lbs per sq. in.) the limit allowed in constructions of steel alone, provided that the steel used has a high tensile strength, with a minimum of 4,200 kg/cm² (56,640 lbs. per sq. in.) for ⅜ in bar and 3,800 kg/cm² (53,260 lbs. per sq. in.) for 1¼ in. bar. The yield point must be not less than 0.6 and not more than 0.7 of the breaking load, and the elongation not less than 25 per cent. This regulation was accepted by Berlin building authorities on May 15. "Concrete and Constructional Engineering" (London) in commenting on the new Prussian regulations for reinforced concrete states that the change is in line with recommendations of the German Concrete Association which maintained that the old regulations fixed the allowable tensile stress in steel at an unduly low figure. This change will have the effect of facilitating the economical use of reinforced concrete in new erections.

A total of 16,738 cubic yards of concrete were placed on the Panama Canal during the month of August as against 17,568 cubic yards in July.

The tall steel towers carrying the counterweights and operating ropes for the Hawthorne avenue lift bridge, Portland, Ore., are carried on channel piers consisting of pairs of concrete cylinders connected at the top by transverse vertical diaphragms of reinforced concrete. The inclined posts bracing the vertical tower columns, are placed in vertical planes transverse to the bridge and are supported on long reinforced concrete cantilever extensions, projecting from the sides of the pier cylinders. This construction requires a minimum of reinforced concrete and simplifies the steel work, according to Waddell & Harrington, of Kansas City, the designers.

ADAPTABILITY OF FLAT SLAB CONSTRUCTION TO WAREHOUSES AND SHOPS.

By A. M. Wolf, C. E.

Historical.

The first buildings built of reinforced concrete were modeled very closely after the other types of construction then in use, viz., timber and structural steel; as a result these structures were designed along lines followed in the design of the "models," the monolithic character of concrete construction being ignored altogether in some cases to the sorrow of all concerned. After a time the principles of reinforced concrete became more widely known and interpreted more clearly and engineers began gradually to depart from the "beaten paths" of practice in other types and to treat reinforced concrete as a building material of an entirely different character from the then prevailing types, wood and steel. This marks the beginning of the end of the beam and girder type in reinforced concrete construction; the intermediate beams so prevalent in the early designs were decreased in number until in some cases the construction consisted of girders supported on columns with one or two intermediate beams in one direction with the slab reinforced transverse to the beams. In other cases where the spans were not so great the beams were omitted entirely and the slabs carried directly on the girders framing into the columns. The next step was the elimination of the deep girders and providing the columns with flaring capitals to act as supports for the slab, thus forming what is now known as "flat slab" construction. The first building of this type built was the Johnson-Bovey Co.'s Bldg., at Minneapolis in 1906. This growth toward a more economical use of concrete and steel has been gradual and there still remain engineers and builders who have not been convinced that the flat slab type is as economical, strong, and otherwise desirable as the old type of beam and girder construction. It is the purpose of this article to treat the general features of this new type in an unbiased way and at the same time show that it has a great many advantages over the old type of reinforced concrete construction. The subject of the methods of design concerning which there exists considerable difference of opinion among engineers, will not be discussed in this article, the purpose being to treat of the advantages of the type as a whole; the individual merits and demerits of the various systems of flat slab reinforcement, of which there are several, being a subject too wide and technical in its scope to warrant treatment here.

Description of Types.

As is usually the case in any field enjoying a rapid growth there have been devised several systems, some being modifications of others or differing from them in minor details only, and for this reason, only the two main types will be described here. The first system evolved was the multiple way reinforced slab or "mushroom system" consisting essentially of a concrete slab carried on columns with flaring capitals, the belts of bars in the bottom of the slab in the regions between column capitals, being carried up into the top portion over the columns without bending, by passing them over a heavy framework of radial and circular bars formed in part by the projecting ends of the column bars. In this type with all belts of bars passing over the column head in lines directly and diagonally between columns there are three layers of bars over the column.* The next system devised, which is exceptionally different from the first is the two-way reinforced or Akme System flat slab. This system employs the flaring column capital but the radial cantilever and circular hoop, head frame used in the Mushroom System is not used or required. The reinforcement consists of rectangular belts of bars in two directions only, the main belts between columns being bent so as to be in the top portion of the slab over the columns and in the lower part of the slab between the column heads. The bars in the portion of the slab enclosed between the main bands are placed parallel to them and similarly bent, thus reinforcing the upper portion of the

Illinois Wall Paper Mills, Chicago. Condron Co., Engrs. Note That Windows Extend to Ceiling Line.

* For the general layout used in this system, see the details of the Lafayette St. Bridge, elsewhere in this issue.

slab over the middle portion of the main belts in a transverse direction. The bars are bent previous to placing and held rigidly in place by supporting bars resting on concrete blocks, thus insuring their proper position in the finished slab. In this system there are only two layers of bars over the column heads, at right angles to each other. Illustration No. 1 shows the general arrangement of bars and methods of support used in the Akme System. The first building built on this system was for the Hirsch, Stein & Co., at Hammond, Ind., in 1908, designed by a live load of 400 lbs. per square foot.

Advantages.

The general advantages of reinforced concrete over wood and steel as building materials will not be treated in detail here, these advantages being appreciated by nearly all engineers, architects and builders. They are briefly, First, its durability as compared with timber or steel, with consequent decrease in maintenance cost; Second, its increase in strength with age; Third, its undeniable fireproof qualities as proven by actual conflagrations; Fourth, increased stiffness over wood or steel construction; Fifth, the absence of vibration on account of the monolithic character of the construction; Sixth, sanitariness, there being no points or crevices to harbor vermin; Seventh, ease of obtaining materials; Eighth, decreased insurance rates on contents; Ninth, coupled with all these is the advantage of cost, which in many cases with good design and economical layout is less than for fireproof steel constructions. These are the advantages of reinforced concrete in general. The advantages peculiar to flat slab construction alone, will now be treated.

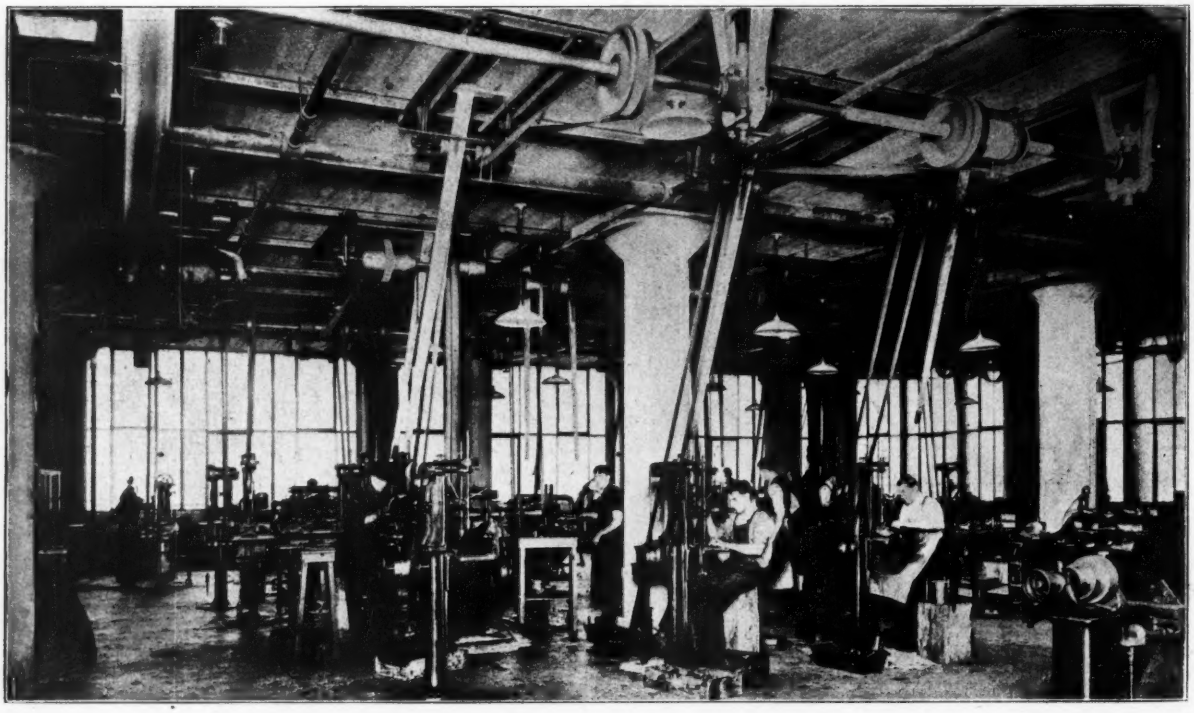
In warehouse construction the main requirements are the load carrying capacity, fireproofness, utilization of all possible space and the maximum capacity for the minimum height of building. In shop or manufacturing building construction the main requirements in addition to the above are: The best possible light and ventilation for the best interests of owners and employes; and construction that will permit of the most economical layout of sprinkler pipes and shafting.

The ease with which these requirements can be met by flat slab construction together with other inherent advantages gained by its use are given in the following:

That flat slab buildings with comparatively long spans can be economically constructed without the use of unduly thick slabs is shown by many tests, where panels of structures have been loaded to two and three times the designing live load without a sign of failure. The new Soo Line Freight Terminal a project covering 11 city blocks, is of flat slab construction, designed for heavy railroad loading and being built at a much lower cost than any other type which could be employed. These tests of actual buildings built under varying conditions should be proof enough for even the most skeptical, that flat slabs will carry even the heaviest loads.

In the old type of concrete buildings there was always a large amount of waste space between the bottom of beams and girders, and the slab which could not be utilized for storage purposes, thereby necessitating a building of increased height in order to obtain the desired amount of cubage. In flat slab construction a saving in height of from one to two feet per story is effected by the elimination of beams and girders, thus reducing the building height 10 to 15 per cent for the same effective story heights. For a building of eight or ten stories of 10 to 12 ft. height, this reduction amounts to more than one full story; this at once reduces the cost of construction, as regards walls, plumbing, heating and elevator equipment. This item should not be overlooked when comparing flat slab construction with other types. In a flat slab building the full story height to the bottom of the slab can be utilized and there are no waste corners or spaces where cobwebs and dirt can collect.

Where flat slab floors are used in most cases, (this however, does not apply to all systems) no deep spandrel beams are required and the windows can be extended to the ceiling, thus eliminating shadows caused by beams and resulting in a better distribution of light. The ventilation in such a building is very much better than where beams are used which form air pockets and hinder the easy circulation of air. Illustra-



Interior, International Register Co. Bldg., Chicago. Condron Co., Engrs.

Arrangement and Support of Reinforcement, Akme System.

tion No. 2 shows very clearly the even distribution of light obtained where the windows extend to the ceiling. It is also interesting to note the large percentage of window area which can be obtained.

Illustration No. 2 also indicates very clearly the ease with which any arrangement of shafting and sprinkler pipes can be obtained on a flat ceiling. The man who has had experience with such layouts in beam and girder construction will appreciate the great simplicity and saving in headroom of the arrangement shown.

In warehouse and shop construction the rapidity of construction is often an important factor and it can be safely said that no other type can excel the flat slab in this respect. The absence of beams and girders simplifies the formwork, and the placing of steel hence the time required for construction is reduced to a minimum. Illustration No. 3 of a building 364 ft. x 127 ft., five stories high, erected at the rate of one story every 10 days, shows very clearly the simplicity of formwork and centering used and the various stages of the work.

Regarding the matter of cost it should be mentioned that in general the cost of flat slab floors is less on account of the lesser amount of concrete and steel required for the same loads and working stresses. In concrete construction the cost of formwork is one of the largest items to be considered. The plain flat surfaces required for forms of slabs are much cheaper than the expensive framing required for beam and girder work. Expensive formwork while adding nothing to the value of the finished building greatly increases the cost.

The great number of flat slab buildings built and under construction is convincing proof of the popularity of this relatively new type. Many railroad warehouses have been built which are giving excellent service under very heavy loads and there is every reason to believe that the flat slab if properly designed and built can be adapted to almost any kind of a building and for almost any loading.

The Signal Department

BLOCK SIGNAL PROTECTION, DURAN TO TECOLOTE, E. P. & S. W. SYSTEM.

B. W. Meisel.

The El Paso and Southwestern R. R. Co. first installed automatic block signal protection in February, 1910, and has continued to increase the number of blocks from year to year. The type of signals used is Hall style "K" and Union Switch & Signal Co.'s style "B" A. C., and style "S" D. C., operating under the normal clear system. In some of the installations the signals operate in the lower quadrant from 0° to 60°, and in other installations in the upper quadrant from 0° to 90°. Within a short time, however, the signals operating in the lower quadrant will be changed to operate in the upper.

The night color indications are: Clear, green; caution, yellow; stop, red. The R. S. A. standard spectacle No. 1040 is used with the signal department's standard semaphore blades, as shown in the illustrations herewith. These blades are made of sheet steel pressed and cut into the form shown, and then enameled according to the specifications indicated on the plan.

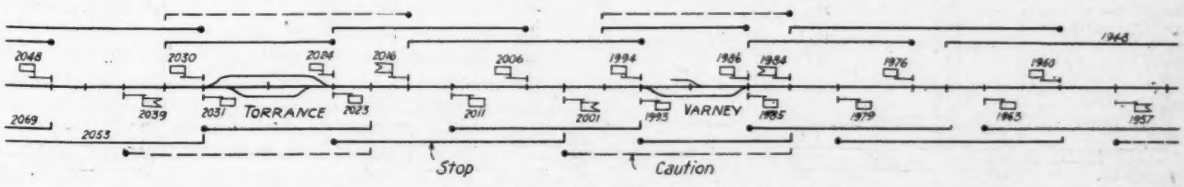
All wiring from apparatus to track is in iron conduit with the G. V. pipe cap used as a bootleg. No. 9 Okonite copper wire is used in the bootleg connections to the signal apparatus.

Built-up cable of No. 14 Okonite copper wire forms the necessary connections between the pole line and signal apparatus. The R. S. A. standard cable post relay box, and the double cast iron battery chute are used wherever such apparatus is required.

The D. C. track circuits are fed from either gravity or soda battery. If gravity battery is used, 2 to 3 cells in parallel supply energy for a track section. If soda battery is used, 3 to 5 cells in parallel supply energy for a track section. The average length of the D. C. track circuit is 3,000 feet. The A. C. track circuits average 2,000 feet in length and are fed from the 10-volt leads of an A. C. transformer at 60 cycles. The primary of the transformer taps a 2,220 volt 60-cycle line. The energy for the A. C. line circuits is furnished at 110 volts, which is also the operating voltage of the A. C. signal motors. D. C. signal motors and line circuits are fed from 16 cells of Edison B. S. Co. primary battery. Line wire is No. 12 D. B. W. P. HD coffer wire.

During June of this year upper quadrant signals were installed and put in operation between Duran and Tecolote, a stretch of 38.5 miles of single track. The protection afforded is shown in the typical layout of single track signals between the mile posts 195 and 204, through the stations Varney and Torrance.

Suppose a train at Varney advances toward Torrance, sig-



Automatic Signal, Overlap Diagram, E. P. & S. W. System.

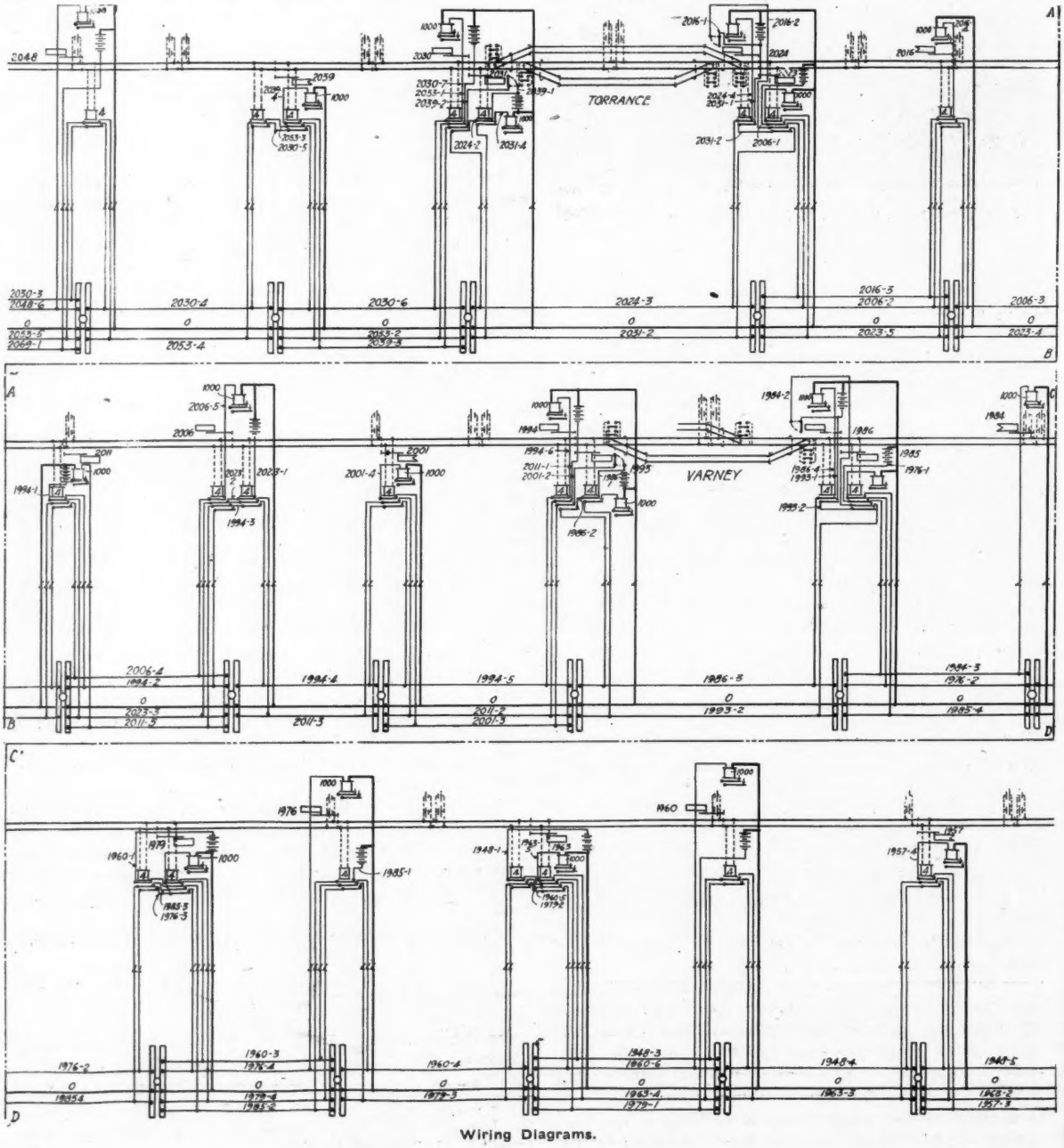
nals 1986 and 1983 will be at stop with 1984 and 2001 at caution, and signals 1994, 2006 and 2016 at clear. When the train passes signal 1994 it will assume the stop position; signal 2011 will indicate stop and 1993 will clear to 90° behind the train, the other signals remaining as they were. When the train passes the cut section between signals 1994 and 2001, then signals 1984 and 1986 will clear to the 90° position, that is, the train clears the overlaps, or the limits of the signal controlls, and the signals clear. A train going in the reverse direction would of course, when passing these limit points, set these signals to the caution and danger position. As the train proceeds towards Torrance and passes the cut section in the track at signal 2001, signal 2023 will be put to stop and signal 2001 will clear behind the train. Signal 1994 will clear when train passes signal 2016, and when it passes the cut section between 2016 and 2023, signal 2031 will indicate stop and 2039 caution. Signal 2006 will clear when the train passes signal 2024, as indicated by the extent of the overlap.

In the same way the signal protection for a train in the reverse direction may be followed out by referring to the overlap, which represent the extent or limits of the signal controls. The typical circuits shown here are the development of the signal layout discussed above.

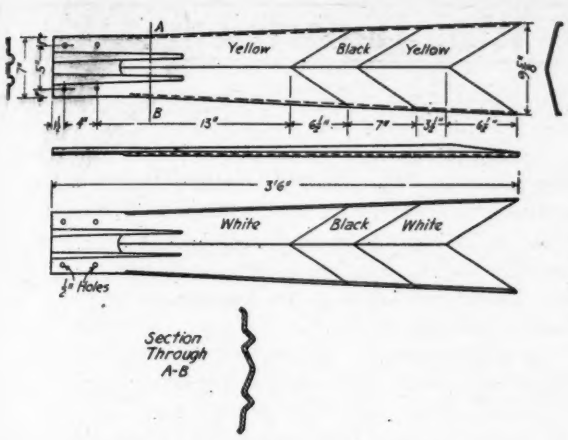
We are indebted to J. L. Campbell engineer maintenance of way and to D. R. Morris signal engineer of the El Paso & Southwestern Ry. System for the information and plans from which this article was prepared.

The crossing bells of the Hoeschen Mfg. Co., Omaha, Neb., have been adopted for standard highway crossing protection by the Southern Pacific system.

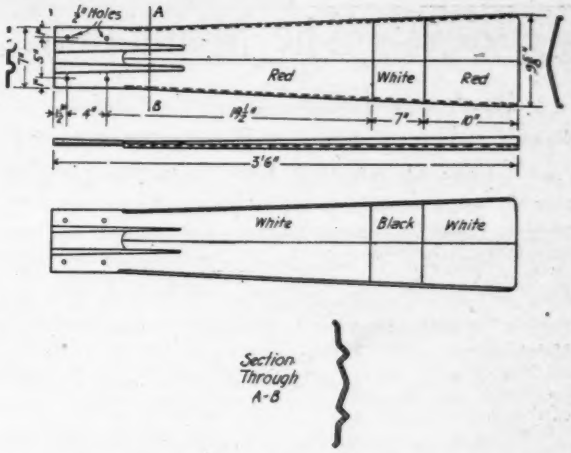
The Western Maryland, according to report, is having surveys made for the construction of a line from Rockwood, Somerset county, Pa., to Jenner.



Wiring Diagrams.



Standard Enameled Steel Distant Signal. E. P. & S. W. System.



Standard Enameled Steel Home Signal.

Personals

Although we are publishing monthly in these columns a practically complete report of all appointments of interest to our readers, it is probable that this information could be published earlier if each subscriber would make it his business to notify us of new appointments immediately. We request and we shall appreciate your assistance in this respect.

E. E. Worthing, formerly signal supervisor, has been appointed signal engineer of the *Galveston, Harrisburg & San Antonio Ry.*, office at Houston, Tex. R. W. Meek has been appointed acting signal supervisor at Houston, Tex., succeeding E. E. Worthing.

W. H. De Chant has been appointed signal inspector of the *New York Central & Hudson River R. R.*, electric division, at New York City, succeeding R. E. Taylor, who has accepted a position in the signal department of the Union Pacific R. R. at Green River, Wyo.

O. K. Boles, signal supervisor of the *Pennsylvania Lines West*, has been transferred from Carnegie to Pittsburgh, Pa. C. P. Woodson, signal supervisor, has been transferred from Bradford to Columbus, O.

The Great Northern and the Canadian Northern have installed an interlocking plant at Virginia, Minn., at a cost of $35,000.

The New York, New Haven & Hartford directors are said to have authorized the expenditure of $365,000 for the immediate extension of the improved signal system which has already been installed over a portion of the road.

The Toronto, Hamilton & Buffalo has recently let a contract for the installation of automatic block signals between Vinemount and Welland, Ont., 27 miles.

The Great Northern has plans for the construction of a steel and concrete ore dock at Allouez Bay, near Superior, Wis., to replace the present timber structure.

The Kansas City Terminal Co. has let the general contract for the station power house for the Union station to the Fogel Construction Co. of Kansas City.

The Jacksonville Terminal Co. has plans for a new station at Jacksonville, Fla.

D. H. Burnham & Co., architects, Chicago, have submitted to the mayor, Cleveland, Ohio, tentative plans for a new union station and approaches to be built by the New York Central and Pennsylvania lines, to cost about $17,000,000. Alternative plans are included for a bridge and a subway approach to the tracks, which will be elevated 22 ft. above the present level.

The shops of the New York, Chicago & St. Louis at 93rd and Washington avenue, Chicago, were completely destroyed by fire on September 24. About a dozen engines were in the shops at the time.

The Northwestern Pacific has prepared plans and asked for bids for a new depot to be built at Petaluma, Cal.

The Oregon-Washington R. R. & N. and the Chicago, Milwaukee & St. Paul have let a contract for a new union station to be erected at Spokane, Wash., to Grant, Smith & Co. Work is to be started at once and completed within nine months. It will cost $650,000. It will be on Trent avenue between Stevens street and Washington street. It will be 300 feet long and have a width of 58 feet. The main structure will be four stories high.

Morris L. Cooke, director, department of public works, Philadelphia, has asked for bids for putting up bridges as follows: On Fifty-fifth street under the Philadelphia & Baltimore Central, a double track 3-span steel railroad bridge to have a total length of 88 ft., with concrete abutments; on Tenth street under the Tabor branch of the Philadelphia & Reading, a three-track single span about 90 ft. long, and under the Newtown connecting railroad a double-track single span, both to have steel superstructure and concrete abutments, and at Lucerne street over the Oxford road branch of connecting railway, a 35-ft. concrete arch highway bridge. The cost of the work is to be paid for jointly by the city of Philadelphia and the railroads whose tracks they cross. In addition a bridge is to be built on the line of Eighty-fourth street over Darby creek, the cost to be paid for jointly by Philadelphia and Delaware counties

The Philadelphia & Reading, it is reported, has given a contract to P. Campion, Mahanoy City, Pa., for putting up the steel and brick freight house, also the office building at Schuylkill Haven, Pa.

The Richmond, Fredericksburg & Potomac and the Atlantic Coast Line will erect a passenger station at Richmond, Va. This, with other buildings and accessories, it is reported, will cost about $1,000,000.

The St. Louis, Iron Mountain & Southern is reported to have sustained a loss of about $50,000 in the destruction of freight and passenger depot and shops at Hot Springs, Ark., on September 5.

The South Carolina Western is reported to be in the market for 500 tons of bridge steel.

The Southern, it is reported, will erect a union passenger station at Spartanburg, S. C., to cost $70,000.

The General Railway Signal Co., Rochester, N. Y., has taken a contract for the installation of automatic block signals on the Toronto, Hamilton & Buffalo, from Vinemount, Ont., to Welland, 27 miles. With the completion of this installation the line will be block signaled throughout its length from Hamilton to Welland, 38 miles.

The Maintenance of Way Department

Roadmasters 31st Annual Convention.

THE ROADMASTERS' AND MAINTENANCE OF WAY Association's thirty-first annual convention was probably the most successful one ever held by this association.

The attendance was the largest ever recorded, and committee subjects were well chosen and discussed at length. Some live subjects were continued over until the next convention, notably the subject of Combined Organization of Maintenance of Way Forces.

The Roadmaster is gradually becoming a more important official, and rightfully so. The trouble seems to have been, in the past, that a Roadmaster was credited with being and paid only as a track man. He must know track, assuredly, but his greatest value lies rather in his ability to mobilize, organize and direct forces, and to plan out work to the best advantage. The responsibilities of his position were formerly lost sight of apparently. Only those who are responsible for the work of a large number of men realize the load such responsibilities place upon a man.

Choosing Chicago as the meeting place for the 1914 convention was a wise move, as it is centrally located and more accessible than any other city. Meetings in Chicago are bound to be better attended than if held at some city not centrally located. A more extensive track supply exhibit is also assured at Chicago, as has been proven by every convention held in that city.

The constant support of the work of the Roadmaster's Association will benefit the members and gradually compel fuller realization of the importance of track forces, especially if the committee work is made the primary object of the meetings, and all entertainment and pleasure trips are deferred till the close of the convention proper.

Wm. Shea, the latest addition to the Past Presidents of this association, is entitled to abundant credit for the largest and most successful convention ever held by the association.

Roadmasters' Association

Report of 31st Annual Convention.

The 31st annual convention of the Roadmasters and Maintenance of Way Association was called to order by President Shea, Tuesday morning, at 10:30 a. m., in the Auditorium Hotel, Chicago. The attendance at the opening of the convention was greater than in any previous year. The membership was increased by 134 new members enrolled during the year, making a total of about 650.

Following prayer by Reverend W. E. Hopper, Mr. W. H. Penfield, assistant to vice president of the Chicago, Milwaukee & St. Paul Ry., gave a talk welcoming the members of the association and assuring them of the interest of the railways in their work. He mentioned the fact that it was necessary to look for economies in the track department on account of the low transportation rates. He also called attention to the need for better track standards and to the ideals of the track department, such as unbreakable rails, good tie plates, good rail anchors, section men who don't quit and ballast that requires no further attention after placing.

A. H. Weston, president of the Track Supply Association, gave a short talk congratulating the Roadmaster's Association on its prosperous condition, and calling attention to the large number of exhibits of the supply men.

A. M. Clough, past president, gave a short talk and introduced W. C. Kidd. The latter called attention to the fact that his prophecy had come true, made a year before, that the 31st annual convention would be the largest in the history of the Roadmaster's Association.

Mr. Ross, representing the mayor of Chicago, welcomed the members of the association.

Mr. Shea, in his address, called attention to the extra work thrown on the roadmasters during the last year due to the destructive floods. He asked for free discussion of the committee reports, but urged the members to confine their remarks closely to the subject in each case.

Short speeches were made by six past presidents of the association, who had been given places of honor on the plaform. They spoke in the following order: J. M. Meade (A. T. & S. F. Ry.); J. A. Kerwin (Erie R. R.); A. E. Hanson (A. T. & S. F. Ry.); James Sweeney (C. & E. I. R. R.); T. Thompson (A. T. & S. F. Ry.) and A. M. Clough (N. Y. C. & H. R. R. R.).

ACCIDENTS, PERSONAL AND OTHERWISE, VIEWED FROM A MAINTENANCE STANDPOINT.

1. The word accident is defined by Webster as "An event proceeding from an unknown or an unforseen cause." It will be observed, therefore, that accidents to which little or no thought is given, are of constant occurrence. Personal accidents have been considered by your committee as those occurring to persons wherein more or less injury or loss of life has been sustained. The Maintenance of Way Department of a railroad is, of course, most interested in accidents attributed to defects in maintenance of way standards, and the roadmasters most of all in accidents resulting from defects in road bed. Statistics show that the road bed can not be charged with an undue proportion of accidents resulting in personal injury.

2. From the latest reports obtainable from the Interstate Commerce Commission, the second quarter of 1912 in which only accidents resulting in property losses of over $150,000.00, whether attended by personal injury or otherwise are included, we find that out of a total of 3,398 accidents reported, only 503 were due to track defects. This we can consider remarkable when we observe that the track and road bed are subject to never ending and sudden strains and shocks that no other feature of railroad equipment is subject to, and that it is being kept up by the poorest paid class of labor to be found anywhere in a railroad organization. It must also be borne in mind that every change in weather conditions, no matter how slight, brings with it an attendant change in the track and that extremes in weather, from which there is no escape, affect the roadbed in ways that even the most learned have yet failed to determine fully.

3. From this same source and the same period, viz.: the second quarter of 1912, we learn that out of a total of 135 killed and 2,934 injured, 24 were killed and 682 injured in accidents from track defects, the balance being distributed among collisions of various kinds, defective equipment, etc.

4. In view of the special efforts and large sums of money being spent by railroads to prevent personal injuries or accidents and the intention being given this feature of the subject by men who have specialized in this class of work, your committee does not feel that much has been left undone for it

to consider. We are in hearty sympathy with the Safety First movement and feel that much good can be accomplished. We are pleased to note a growing tendency toward fairness in placing blame for personal accidents, and hope that the time is not far distant when the person or persons responsible for the placing of boards with nails sticking up, leaving draw bars too close to rails, or switching cars in such a manner as to cause coal, scrap, or other material to fall from them, will get full credit for their carelessness, and the track department released from blame. As we all know, it is a most difficult matter to get written reports from section foremen, but your committee recommends that the foreman be encouraged to report all cases of gross carelessness, fixing the blame where possible, the time and date when discovered. When such reports come, the roadmaster can send them on to his superintendent with a request to be advised what action has been taken. Or if it is thought best, a letter can be written and the original report filed. We feel that if the Right of Way must be raked clean daily, more help must be furnished. We would prefer, however, that each individual assumes his own responsibility, thereby making it in reality, "safety first" instead of "safety last."

5. With respect to accidents other than personal, your committee feels almost as poorly prepared to analyze this as it does personal accidents. Referring again to the Interstate Commerce Commission, we find that out of the 503 accidents attributable to defects of roadway, 45 were attributed to broken rails, 51 to spreading rails, 113 to soft track, 10 to bad ties, 10 to sun kinks, 182 to irregular track, by which we assume is meant bad line, surface or gauge, and 92 miscellaneous, which would cover defective switches, frogs, guard rails, crossing plank, etc. During the same three month period, there were 1,145 accidents due to collisions of various kinds, and 1,032 due to defects in equipment. A comparison of these figures, the most authentic and recent obtainable, should tend to keep our spirits up and cause even greater effort on our part for a better showing. It is to be hoped that our managements will take cognizance of our efforts, bearing in mind that there is no department in the railroad field that stands so alone and receives so little encouragement as the Maintenance of Way department; its very existence seems to be deplored by many of the other departments. Referring for only a moment again to figures quoted, for comparison, we urge to offset the accidents due to broken rails, the most careful inspection and testing of rails at the mills, and the furnishing of rails of a weight commensurate with the loads to be carried and the speed to be provided for.

On a certain division of an eastern trunk line road, not yet fully provided with the automatic block signals, and during a period marked by an unusual number of rail failures, the practice was adopted of paying a $5.00 reward for every broken rail found by individuals not connected with the road. This resulted in the track being looked over by many persons living nearby, dozens of times per day in some localities, and the finding of many broken rails at times when section men were no where near. The rural telephones offered a prompt means of communication with the nearest telegraph office and train crews were promptly notified, who in turn notified the nearest section gangs. The roadmaster on whose section this experiment was tried did not commit himself as favoring it, but said some wrecks were no doubt averted by this added incentive to vigilance by outsiders.

6. Spreading rails, to which 51 accidents were attributed in a three-month period, rests almost entirely in our own hands. "Almost" is used advisedly we believe, as we do not concede it is entirely so. For instance, we do not feel that responsibility should rest on us for track spreading due to engines going in on turnouts at too high speed, nor should we shoulder the blame for certain types of engines which have been proven beyond doubt to spread track at high speed. Since the question of speed has been mentioned, we might here say that excessive speed is the cause, no doubt, either directly or indirectly, of fully 25 per cent of all accidents. Where accidents result from this cause, it is always said the track is at fault, as the train is invariably proceeding, according to the train crew, at a speed permitted by the rules. One Eastern road is equipping a large consignment of new engines with self-registering speedometers so that the speed of trains so equipped can be checked over an entire division mile by mile. We think it would be a source of much satisfaction to some of us to have such a witness. The question of speed is an important one to be determined. Take for instance curves and bad tracks whereon restrictions have been placed: a speed-recorder would prove a valuable aid in checking up some of our careless runners. We urge their adoption as rapidly as possible.

7. Soft tracks, the most prolific source of accidents charged to roadway and Maintenance of Way department, calls for pretty heroic treatment by the man on the ground, who should be blest with an abundance of judgment, tact, and persistency. Soft track can be attributed in most instances to the lack of, or poor quality of ballast furnished. Many managements are

T. F. DONAHOE, President.

C. H. GRUVER, First Vice President.

L. C. RYAN, Secretary and Treasurer.

Officers of the Roadmasters' Association for 1913-14.

adverse to spending money for ballast. It should be our aim to keep after this feature untiringly, and by pointing out not only the dangers but the consequent loss in money due to shortening the life of ties, rails, etc., bring about a more liberal view regarding ballast. It is a safe bet that many here would prefer a yard of good ballast at a cost of 50 cents to $1.00, to a new rail at a cost of 10 or 15 dollars. Give us plenty of good ballast and we will wipe the slate clean of the 113 accidents resulting from soft track and the 10 resulting from sun kinks.

Bad ties caused 10 accidents. Your committee does not feel that present day conditions justify accidents arising from this source. Watchfulness on the part of the roadmaster to see that the foremen exercise good judgment and watchfulness in taking out ties, should eliminate this trouble entirely. It is true that a section may be short of help for a season, but we do not feel that any foreman or roadmaster should permit a condition in ties that would result in accident of sufficient importance to be included in this report. We shall not attempt to analyze the 182 accidents classified under irregular track, exeept to impress on our superiors the necessity for sufficient and competent help. If we can succeed in getting good rail, ballast and ties, then it is a question of help. Along this line we might say that more help in a supervisory capacity would result in bigger returns in the long run, than would the putting on of additional traveling passenger or freight agents. We do not think that it is fair or good policy to place a roadmaster in charge of a long division with a poor train schedule, and expect him to keep in touch with all the details of the work including coaching and examination of foremen. It is to be deplored that foremen do not get more coaching and more frequent examinations regarding their qualifications.

8. In 92 cases of accidents classified as miscellaneous, we can only recommend eternal watchfulness, good judgment and prompt action. See that switches and all connections are in good condition by frequent inspections, that guard rails are kept as specified, and frogs not allowed to pass the limit of safety as regards wear while at the same time making sure that such material has been used to the fullest limit permissible to a safe track.

9. One feature in connection with accidents of all kinds stands out more prominently than all others and that is the failure of foremen to act promptly and their tendency to put off some job, till a later or more convenient time. Bad storms outside of working hours are also a source of very great danger, and foremen should be educated to make patrols promptly after such.

J. R. Coulston, Chairman, L. E. & W.; C. J. Coon, N. Y. C.; J. J. Hughes, St. L. T.; H. Ferguson, G. T.; D. E. Lynch, C. B. & Q.; G. D. Gifford, N. Y. C.; F. Button, C. & N. W.; T. H. Gaffney, M. P.

Discussion.

M. Burke.—We need more co-operation in this work of accident prevention.

G. S. Brooks.—Co-operation is needed, as are also more stringent rules requiring each department to take care of any scrap materials which are liable to cause injury.

A. A. Wells.—A great many accidents are caused by high speed, and usually are charged to the maintenance of way department. Injuries chargeable to careless employes should not be charged against any department.

T. F. Donahoe.—A speed recorder is a good device for placing responsibility, but is not always dependable.

Wm. Shea, President.—I would like each member to give a specific precaution which will prevent possible injury, such as placing a red lantern on a draft iron which has pulled out.

D. O'Hern.—Sometimes trainmen use a tie to block a train with, and this later causes injury by man falling over it. Such practice should be stopped, and if used, tie should be moved back from track after using.

M. Burke.—I suggest the use of safety switch stands in all territory not automatically blocked.

A. M. Clough.—All railways should block frogs and guard rails.

John Barth.—Holes or piles of dirt near tracks cause injury, and should not be allowed.

Wm. Shea, President.—I have noted cases of crossings with too abrupt approaches, where the body of an automobile will become lodged with all four wheels in the air.

L. C. Ryan.—Accidents can be prevented by buying frogs already blocked, and by unloading and loading rails with a derrick.

W. H. Kofmehl.—Additional inspection should be required where rails are breaking in quantities.

M. Burke.—Accidents from spread tracks will be eliminated if 100-pound rail is furnished with good ties and tie plates on curves. Main line tracks should never spread if sufficient material and laborers are furnished.

James Sweeney.—We need more tie plates, and should never be restricted on necessary new ties.

CONTRACTING MAINTENANCE WORK.

As this is a new subject and only in its infancy, it will be very hard and almost impossible to present facts and figures, especially as to contracting work in the track department under traffic, as we have not been able to find any roadmaster or road who has given it a test. We hope if any roadmasters are at the convention that have, they will give us the benefit of their experience for publication.

The C. C. C. & St. L. Ry., St. Louis division, put under stone ballast after stone was unloaded on the ground, at an average cost of 27 cents per track foot. This was an eight inch average raise and included tie renewals, dressing and filling with American hobo labor at $1.75 per day, a $75 per month foreman, a $60 per month assistant foreman and a $60 timekeeper. A contract has now been let to put stone under in this same territory and we hope to be able to give some facts and figures on the work as done under the contract system.

3. We find that on one of the New York Central divisions it costs 4 cents per track foot to lay rails under heavy traffic. This did not include the unloading of new or picking up of old rail, and we have not heard of rail being laid under contract, and could only give our opinion. If any roadmaster or supervisor has any facts or figures on laying rail by contract, let him present them to the convention for discussion.

4. We have a report from one road where it cost two cents per plate to put on tie plates with foreign labor. This includes adzing ties, plugging old holes, re-spiking and guaging. This, we believe, could be done at less expense if the man had employed good American labor.

5. We have a report on contracting of the moving of right of way on one division at a cost of from $5 to $20 per mile where it cost from $10 to $30 per mile to do it with section men. It was done under the supervision of the section foreman and approval of the supervisor. We also have a report from one road which did standard banking through a level prairie country by hand at a cost by section labor of $1.50 per track rod. The laborers were foreigners and were paid $1.60 per day, and in the same territory the same kind of work was let by contract at $1 per track rod. The contractor paid his laborers $2 per day, and made an average of $16 per day working an average of fifteen men daily. This work was done under the supervision of a section foeman who took charge both of his regular section work and this extra contract.

6. We also have a report where tile ditching has been done by contract at a saving of from 20 to 30 cents per rod.

7. We find that most roads of late years have either been doing all their new track work by contract or under what is called a construction department. In some cases we find this has been satisfactory and in some cases it has not. We are,

however, unable to state which proved the cheaper. However, it is not always the cheapest that is the best.

8. It is an evident fact that a contractor pays more money to his men for the same kind of work than the railorads as a rule allow us to pay, and they get better men and can do the work cheaper. In addition, the contractor is always equipped with the latest labor saving devices, which is not always the case in the track department.

9. There should be no maintenance work of any kind contracted without the strictest provision that it must be approved and made satisfactory to the department, and a competent and experienced man provided by the railroad company as an inspector.

10. Some of the reasons why contract work, so far as it has been tried, is cheaper than section labor may be enumerated:

a. A contractor can pay his men what they are worth to him.

b. A contractor always has a following of expert laborers.

c. A contractor can fortify himself against all conditions and can have his own boarding outfit and supply his men with better accommodations than a railroad company.

d. Laborers understand that when they work for a contractor they have to do their part of the work or drop back to less pay or lose their places entirely.

e. By contracting some of the heavy track work, the supervisor or roadmaster would have more time to devote to his regular work and keep it up to standard. This is an important consideration. It costs much less money to keep a track in condition after it has once been brought up to standard than to build it up again after months of neglect and lack of supervision, which usually results when the roadmaster is compelled to take charge of new steel or ballast work. For then he has to place his best foremen in charge of the extra gangs, must spend most of his time overseeing their work, is confronted with the problem of poor, and in some cases insufficient labor, wastes valuable time locating new gangs of "greenhorns" with the final result that the cost of the work is far in excess of what it ought to be.

f. The rate of pay for all work done by the companies is based on what we call a standard one rate pay for regular laborers, and another rate for extra gang laborers. The poor laborer receives as much as the competent man, no matter what the conditions are. The consequence is that we have a gang of men who are of an inferior class. The roadmaster in charge cannot change their wages, and by the time he has been able to convince the higher officials of his company that he can make a considerable saving by raising wages, the season is too far advanced. As a result the job is finished at a high cost. The contractor avoids all this. He is on the ground. He is in a position to see conditions as they actually are, and in consequence he fixes his scale of wages according to the supply of laborers and their worth.

John Barth, chairman, Big Four; James Burke, Erie; T. Hickey, M. C.; Guy Lowers, Erie; P. Madden, C. M. & St. P.; N. McNabb, M. C.; F. E. Crabbs, C. & N. W.

Discussion.

A. C. Rupp.—We have contracted tile work with excellent results.

Jas. Sweeney.—We have contracted for gravel and tiling with considerable saving. We mow our weeds by contract with teams at $10 per mile, which is a saving of $10.

E. W. Walch.—We contract fence building at no saving, but get more done, leaving section forces on the track.

J. McNulty.—Where possible to obtain the necessary laborers, we do better, generally, by day labor.

N. McNabb.—We find it cheaper and better to contract everything outside of regular maintenance, and keep track forces on the latter.

A. E. Hanson.—We have a fence gang receiving as high wages as contractors pay; we build the fence as cheaply, and much better.

M. T. Toohy.—We find it cheaper to contract for taking care of switch lights at isolated points.

J. P. Corcoran.—We do mowing by contract for $7, which costs $25 to $35 by hand, and get a better job. Tiling we do for half by contract.

John Barth.—We save 10 to 20 per cent by contracting.

G. Beckingham.—Contracting adds to the cost, for section laborers are supposed to do all the work.

N. McNabb.—All contracting of actual track work should be done by a practical track man. If not, the roadmaster is not relieved. I do not approve track laying or relaying by contract, but have had some success with ballasting by contract.

J. O'Connor.—Contracting surfacing has been a failure with us. It cannot be done cheaper than by section forces.

I. C. Ellison.—We ballasted 1,000 miles by contract, inspected by a young engineer, with unsatisfactory results. Improper tamping and obstruction to traffic were the rule and not the exception. We obtain better work at the same price, with section forces.

COMBINED ORGANIZATION OF MAINTENANCE FORCES.

On account of so much unnecessary lost time in moving small repair gangs of the signal, bridge and building departments, or even mechanical department over the road, it has frequently been advocated that, by raising the standard of our present track forces, much time and money can be saved by the railroads of this country.

2. Probably all of us have had similar cases which have called the necessity for such a change before our minds.

For instance, an agent wires he has three or four broken panes of glass to be replaced at his station, and gives the dimensions. The glass is forwarded and a man is sent out to make the repairs. His train leaves the terminal at 9 a. m. and arrives at his destination at 11 o'clock. He finds that two of the lights fit, while the other is off size a slight amount, necessitating his waiting for another glass, and very likely his returning to headquarters for it, and another trip to the town next day.

A conductor sets out a bad order car at some small station and leaves a description of the defects with the operator, who in turn notifies the proper department. It very often develops that the information is in error, and second trip of the repair man is necessary.

3. Dozens of similar cases have led many operating men to believe these minor repairs can be taken care of by the men on the ground. Just how seems to be the only obstacle confronting them.

Perhaps most of us will favor the idea of having one man in a section gang at a rate sufficient to secure a good, reliable man who can look after such work. Such a man may or may not be required at each section, this depending upon the importance of the station or section.

4. Another idea advanced by some is to allow each section enough men at the advanced wage to take care of the winter section force. This will be an incentive for the laborers at ordinary wage to try to obtain the steady job and higher rate.

5. For the officers of such an organization, we necessarily will need well balanced, all around men.

Such men, however, should not be hard to secure, especially after a few years of operating with the higher class of section men who will have developed into good foremen and road masters.

On acount of the necessary requirements, the head of the maintenance department will necessarily be a more lucrative position than that of our present day roadmaster or supervisor, and still at the same time the supply will necessarily have to be drawn from the track department.

Some roads have taken steps to combine their maintenance forces, the track and signal forces being the ones most generally considered. It is reported that while some roads favor the combination, other do not. One middle west road gave

this plan a tryout this season and has now abandoned it entirely, as it was found the track condition depreciated while the cost remained as great or greater than before the signals were taken over.

This committee as a whole does not favor any further duties being imposed upon us for fear our roads will not allow the necessary compensation to make it a success.

Emmett Keough, Chairman, C. B. & Q.; A. E. Hansen, Santa Fe; B. C. Dougherty, C. M. & St. P.; P. J. McAndrews, C. & N. W.; F. B. Adams, P. & R.; C. Linehan, C. R. I. & P.; E. J. Boland, I. C.

Discussion.

W. C. Cole.—If you pay an expert laborer more money than the others, you create dissatisfaction.

W. R. Thompson.—With combined organization we could save at least 50 per cent on the small, scattered jobs.

J. P. McAndrews.—I think combined organization will work out advantageously to both track and signals. Our opening up of this subject should result in a general investigation of the whole system of railway organization, in which there is, in many cases, lost motion and therefore loss of money. Frequently the signal men lay the blame on section foreman for signal failures, and make them renew perfectly good insulation at joints.

N. McNabb.—If you put the signal maintenance work and carpenter work on the track forces they will have no time to devote to track work.

J. P. Corcoran.—The Chicago & Alton tried out combined maintenance and dropped it. It keeps the section foreman off of track work, and usually three or four men with him.

J. Burke.—Merging these forces will promote economy. A foreman can be educated as well as the men who are now signal maintainers. Besides, the better wages paid will procure better men.

Wm. Shea.—Give a man an opportunity and you can many times make a good man out of him; I think it would work out this way in the case of the section foreman.

John Barth.—Under present conditions we are called on for considerable outside work, but get no additional help, which would be furnished under combined maintenance.

E. Keough.—We contend that better pay for men will produce a class of track laborers capable of developing into all around men.

NEW APPLIANCES.

Manganese Steel.

Manganese steel was first used, to our knowledge, in the heavy wearing parts of electric railroad special work. The great expense in making and finishing manganese castings in the earlier days made it necessary to limit the size of the manganese parts to avoid prohibitive cost as compared with the existing forms of construction. The steam railroads began using manganese steel in limited quantities in crossings about the year 1901, and as the manganese steel consumption increased, the cost of production was gradually reduced, so today manufacturers have found it possible to increase the size of manganese castings until we find during the past three or four years, solid frogs and crossings, made of this metal, eliminating the rolled rail section altogether. From our personal experience in solid frogs and crossings, we believe as a general proposition we have in many cases gone to extremes with manganese steel. Like in all other things, there is a limit to the extent to which the same may be used profitably.

Manganese steel has become a great factor in maintenance of railroads in this country in the past few years. Yet there is quite a difference of opinion among the users and manufacturers of frogs, crossings and switches as to just what saving there is obtained in the use of manganese steel as compared with the older forms of construction for frogs, crossings and switches where built up with the ordinary rolled steel rail, either bessemer or open hearth quality. There is no question that the application of manganese steel will prolong the life of frogs and crossings, but it is unfair in making comparisons to lose sight of the fact that improvements of design in the built up rail crossings and in the rail itself have also been made where these track structures are entirely of rolled steel section as well as when manganese is involved.

We believe that there have been cases reported where results obtained with manganese construction have so far excelled previous records that there seems to be no question as to its superiority over the frogs and crossings made of steel rail. It has been frequently asserted (mostly by men representing manganese steel) that at certain locations the ordinary frog built of rail has a life of from sixty to one hundred and fifty days, or from two to five months, whereas a frog with manganes insertions, in the same location, has lasted from one to two years and is probably still in service; likewise that crossings give all the way from five to fifteen times the service when made of manganese as compared with bessemer steel.

While these tests may apply to rare cases, it does not prove that the results will be the same when used in greater quantities. The failures must be taken into account, as well as the successes, in judging the true economy of any proposition. As you all know, manganese steel as generally used in track work of the present day, is a cast product and differs from ordinary cast steel by having a small per cent of metal, known as "manganese" put into the cast steel before molding. By undergoing a heating treatment it is given the tough qualities that make it so desirable in track work. Manganese steel is not high tension or hard metal in the usual sense of the term, and has no quality that makes it of value for cutting tools, in spite of the fact that the material itself is such as prevents it being cut or drilled to advantage by the highest grade of tool steel. Manganese steel, after being cast, goes through a heating and cooling process which makes the surface of the frogs or crossings so hard and tough that the wear on them under car and engine wheels is very little.

It is an evident fact that it is very much more difficult to obtain perfect castings where the size is as great as a complete railroad crossing, or even half of the crossing, or where crossing frogs are required in lengths longer than eleven feet. While perfect castings of extreme size and length have no doubt been made, there is, in our opinion, a very good chance of getting more bad castings than good ones. For manganese crossings and frogs to give the best service, the casting must of course be perfect. One blow-hole, crack or flaw may cause a complete failure in a very short time after being put into service.

It is our opinion that if crossings and frogs cast of manganese steel could be made of greater height than our ordinary 80-lb. to 100-lb. "T" rail, the crossings and frogs would give better service and not be so liable to crack and break, especially crossings. As this cannot well be done in a great many instances on account of the crossing lying on the portion of the tie that goes under our ordinary "T" rail, we would recommend, to overcome this, that the limbs, or running rails of the crossing be made much wider or, in other words, heavier than in the crossings furnished so far.

Poor designs and skimping of weights to reduce cost have been the cause of failures in crossings to our personal knowledge. Solid frogs have likewise been unsuccessful when cast with long arms to meet existing rail closures, where the frogs were to be used. There is no doubt in our mind that we have in manganese steel a metal that adapts itself particularly to this class of work on account of its resistance to wear, its toughness, and the fact that it may be readily cast to the forms of track construction. We should use it in such a way that these advantages are not dissipated by improper design and application.

In rolled rails was found an elasticity that caused the track structure built of it to rapidly displace the older forms of solid castings, and it was only when the rails became heavier

and the built-up frogs and crossings through reinforcements became more rigid, that the strain on the rolled metal became such that the life of frogs and crossings under constantly increasing tonnage necessitated a more durable material. Manganese metal, with the elasticity of a rail structure, in such a ganese cast into frogs and crossings has to a great extent overcome our difficulties. We have used manganese steel both in crossings and frogs (crossings in two and four pieces, and frogs in one piece) and have also used frogs and crossings with hard centers, or, as it is called, "manganese insert." This is a combination of rolled rail and this durable manganese metal with the elasticity of a rail structure in such a way that the strain is distributed over several ties, and, from our experience, we are inclined to recommend the inserted work in preference to the solid frog or crossing unless, however, a crossing is made of four pieces eleven feet long.

We would recommend that in all cases where insertions of manganese steel are used in building railroad crossings, that the running rail be made full size in all cases where it is at lb. rail, boring six holes with his track drill (four for the bolts in the corner of the crossing and two for the splice, or joint, at the end of the limb) and inserted the rail in a very short time. This crossing under the same amount of traffic bids fair to give service for at least two more years.

We observed another crossing of the inserted type at an angle of about 22 degrees with mitered rail connections that has been in service about two years. The rails, of course, are yet in pretty fair shape, but when these rails wear out or break down, should they do so before the hard corners are worn out, the crossing will either have to go to the scrap heap or be sent back to the shop to be rebuilt. In the meantime, another crossing would have to be inserted in its place which, of course, would mean a duplicate set of crossings. This would be very expensive and on that account we don't believe the management of many railroads would approve of it.

The foregoing remarks reviewing manganese steel in railroad track maintenance might leave the impression that we are not highly pleased with its use. We assure you that this is

Part of the Members Who Attended the Roadmasters' Association Convention.

all possible to do so, and square at the ends with abutting manganese portion, or hard corner of the crossing; this to be done in order that the repair gangs in charge of the tracks in case of rail failures can take a piece of rail of the same section by cutting it off square at the end, boring the holes in the proper place in the rail, inserting the running rail and repairing the crossing with a few moments time while if the abutting end of the rails to the manganese steel are made with mitered corners and the flanges and heads planed, or ground off, the crossing in case of a broken limb, or running rail failure, would have to be taken out of service and scrapped or sent back to the frog shop for repairs.

Some companies have in use all types of the crossings above mentioned. One, we noticed, has a crossing in service of the inserted type at an angle of 28 degrees, limbs of which are of the A. S. C. E. 80-lb. rail. This particular crossing has been in service for the past three years and three of the running rails that abut the manganese corner have worn out and broken down, and the section foreman in charge of that section made repairs to the crossing by simply cutting an 80-

far from the fact as we have simply tried to state our experience with manganese steel as it has been our privilege to see it. From our experience, we know that the maintainers of railroad tracks have in manganese steel a material that does not only reduce the cost of maintenance but, at the same time, crossings and frogs are maintained at a higher standard and the track thereby made smoother for traffic. What we have recommended here is manganese steel for frogs, crossings, etc., and should not be misconstrued as meaning rail for general track use.

Tie Plates.

The modern types of tie plates which are now in general use are the tie plates with smooth bottoms and with bottoms with shallow corrugations or ribs of about ⅛ inch in depth. Also with shoulders for holding track to gauge, an important feature. However, in the evolution of the tie plate, it was made to fill a second purpose, that is, to resist the lateral thrust of the wheel flange and to hold the track to gauge. We believe that it has been the general experience of roadmasters, using smooth bottom tie plates, that this type of plate does not

present any great resistance to track spreading, because the only added power given to this plate is the holding power of the inside spikes, and that preference should be given to such tie plates as do in themselves present resistance to track spreading, if at the same time the bottom design is not such as to work injury to the tie. For this reason we believe that the experience of roadmasters in general is that, everything considered, a shallow corrugation bottom is by far the best design of a tie plate. This type of tie plate is made in various designs, some with two to four ribs on the bottom running in the direction of the grain of the tie when it is applied, some with two to four ribs running transversely across the bottom or across the grain of the tie, and still others with the corrugations running diagonally across the bottom of the tie plate in both directions, crossing each other and forming what is called the waffle iron or anchor bottom. We believe it is the experience of the roadmasters who have used this last mentioned design of plate, that it best holds the track to gauge, as when the plate is seated on the tie it cannot move in any direction.

Tie plates are being manufactured from malleable iron, wrought iron and steel. In a comparison of these articles we believe that wrought iron is the best material for tie plates. It is claimed that malleable iron resists corrosion and deterioration from salt brine drippings better than either wrought iron or steel, but it has been our experience that there is practically no difference in the corrosion of wrought iron and malleable iron from brine drippings. Both of these materials resist corrosion much better than steel. It is a well known fact that in some cases excessive brine drippings have eaten the entire shoulder off steel tie plates.

The committee's attention has been called to numerous other types of plates and there is one that we consider worthy of serious consideration. It has a perfectly smooth bottom and is secured to the tie with screws or special or common track spikes. It is independent of the rail and the latter is secured to the tie by a shoulder and hook which is four times the area of a common spike on the outside while on the inside the shoulder has the height of the flange of the rail and one common spike. These tie plates can be put on with the hook outside and inside alternately thus making an unusually secure and perfect track construction.

Wrought iron plates of the proper design cannot be broken while plates of steel or malleable iron are frequently broken under traffic, the break generally being along the shoulder.

We believe that special attention should be given to the method in which tie plates are rolled. It has been found that wrought iron tie plates which are rolled with the fiber running in the direction of the shoulder, or in other words, in the same direction as the rail, when they are in track will break very easily. This also applies to steel tie plates which are rolled in the same manner. Wrought iron tie plates rolled with the fiber running across the shoulder, that is, at right angles to the line of rail, and steel tie plates rolled in this manner, do not break in service.

Hard Center Spring Rail Frogs.

We are all familiar with the hard center rigid frog. Its merits have been fully discussed at previous conventions; also the solid rigid manganese frog, indispensable for yard tracks now, but it is still a disputed question whether they are really the proper frog for high speed tracks to replace the spring rail frog, the only fault of which was that manganese had not been introduced in its construction. Now, however, we have a hard center spring rail frog, the rigid wing point and filler all in one piece with a manganese steel spring wing so that with the wear we get with the rigid hard center frog proportionate with what we get from a spring rail frog of the same material, we will have a very durable article for maintenance of track.

One Piece Guard Rails.

Next to a frog in importance, for strength, durability, and easy application, we recommend a one piece guard rail. By one piece we mean a guard rail with braces, tie plates and fillers, all in one piece, made of manganese steel and practically indestructible. We believe that it is just as essential to have a properly manufactured guard rail as to have a manufactured frog or switch and get away from the old style guard rails made from inferior rail and neither very strong nor secure at their best, continually causing derailments and heavy expense for maintenance.

An Improved Track Bolt.

A bolt is being manufactured for track purposes with an elastic limit of 75,000 pounds per square inch. Tests have shown this to be so, giving the bolt the property of a nutlock as well as a bolt. We, therefore, recommend a bolt that will not become loose after once applied.

An Improved Track Drill.

We have now on the market a drill with an automatic chuck, self acting just as you secure a bit into a carpenter's brace, with ball bearing gears and by the movement of a single little lever, the drill will run forward or backward. It is a simple, strong and durable machine which we would recommend.

A Ratchet Wrench.

We are looking for, but so far have been unable to find, a ratchet wrench suitable for tightening bolts with a motion similar to a ratchet drill. Some are on the market but fail for the reason that when the nut is first put on to the bolt, it does not offer enough resistance to bring the ratchet of the wrench into play, simply moving the nut back and forth. Suggestions are invited.

A Simplified Track Jack.

We believe we have on the market a simplified track jack of fewer parts and of greater efficiency. The manufacturers are prepared to show this to anyone interested. This is worthy of consideration.

An Improved Insulated Joint.

An insulated rail joint with shoulder tie plate is a new feature in track insulation, as the plates that support the rail insulation are in direct contact with the base of rail, the same as the general purpose joint. The fiber sheet between the plate and the rail is being entirely eliminated and is a long step towards making insulated joints easier to maintain and cause less trouble and failures from the signal man's standpoint, and this is well worth our most serious consideration. As track men have to maintain insulated joints on most roads, we recommend improved insulated joints that do not require constant attention as many do which are now in use.

Tie Tongs.

We have had experience with a tie tong and, after observing it in the hands of the section men, we are of the opinion that such an appliance is a valuable adjunct to the track department and recommend its general use.

A Machine for Removing Ties.

Since the general use of stone ballast on our lines, it has been an expensive and also a very laborious job to renew ties, it being very much harder to pull in ties in stone ballast than in gravel. We are pleased to note that one manufacturing concern has started the perfecting of a machine for this purpose with a windlass arrangement and steel cables the length of the ties. With a support against the opposite rail, a tie can be pulled out or in, both without digging so deep, and very much easier than with the pick or tie tongs, reducing the cost of putting in ties with much better results.

We hope to see this machine made so that it will come into general use.

Switch Stands.

1. The use of automatic safety switch stands, especially for yard use, with full adjustments as provided by some manufacturers, is to be recommended.

2. A safety automatic switch stand must be automatic under all conditions; that is, it must be automatic when latched and locked, and when operated by a train trailing through at high speed as well as at low speed.

3. There are also many stands on the market with breakable features which are very objectionable; for when a breakable feature has failed, the switch points are left loose with the target showing the same as if the switch were in correct position and securely held. The breakable feature stand is also liable to fail in service in case sufficient care is not used by the manufacturer in figuring out and maintaining the pressure at which same should fail, which is a very difficult matter to do on account of the difficulty in keeping the strength of the metal uniform.

4. On account of the objections to the breakable feature stand, we would recommend a stand that when trailed through when set wrong, will throw automatically, the target indicating the new position of the switch points and the switch left in proper condition for either hand or automatic operation.

5. It is recommended that switch stands with full adjustments be provided so that the stand once spiked down need not be moved on the ties. The form of adjustment for the throw recommended is the screw eye crank with the diameter of the screw not less than 1½ in.; and with six threads to the inch; ½ turn of the screw eye will afford an adjustment of about ⅛-inch in the throw of the switch stand.

Targets for Switch Stands.

Targets of the interlocking type in enameled colors (known as the Ramapo Target) are recommended.

This type of target cannot become loose or accidentally detached from the switch stand spindle. These targets have interlocking recesses, like a hinge, and slip over the top of the switch stand spindle, which is squared so that targets will always register at proper angle to the track.

Nut Locks.

Forty years ago, looseness in a rail joint was due to nut movement, but today it is the concensus of opinion that this looseness develops in the joint itself and that nut movement is practically negligable.

Longitudinal movement in a rail joint is essential to allow for the constantly occuring contraction or expansion, and results in a continual frictional loss, which must be overcome by constant tightening of bolts to prevent the rail and angle bar from wearing at the joint and stretching the bolts.

We believe that this can be remedied by a type of nut lock or spring lock washer whose power is less than the safe load which the bolt will carry, but is sufficient to hold the joint parts in contact with the rail against the force of the rolling load. When such a nut has been brought flat by a laborer, we can know that the bolt is sufficiently tight. When it has not been brought flat we can tell that the laborer is not doing his work.

Bumping Posts.

An almost indestructible all steel bumper with very strong springs attached has made its appearance, also the corrugated car stopper, and we would call our members most careful attention to the progress being made in this particular line for our benefit; also other types which fasten to the track rails, and without any wood or any fastening below the ground; this last type, from our experience, we recommend.

A Steel Car or Boarding House Bunk.

We believe a perfect solution of sleeping bunks has been found in the all steel bunks just put on the market. They are strong, thoroughly braced, double or single deck, coated with a rust-proof black enamel, and apparently fill a long-felt want. We recommend their use.

W. H. Kofmehl, chairman, A. M. Clough, G. H. Brooks, J. P. Corcoran, Wm. Hazelwood, W. H. Cleveland, G. M. Green.

Discussion.

M. Burke.—Manganese frogs require less than 1/10 the maintenance of Bessemer rail frogs, and last immeasurably longer.

The discussion, in general, favored manganese frogs strongly, though some failures were noted.

The report on tie plates was accepted as information after considerable discussion.

A roadmaster of the Central R. R. of New Jersey, described a "cushion tie plate" in use on that road. This plate has a rib around the entire edge on the bottom, which prevents dirt getting under before the plate is thoroughly seated. Cross ribs are also provided, giving a good bond with the wood.

The article on spring rail frogs was accepted as information, and that on guard rails accepted as read.

N. McNabb, of the Michigan Central, said he had used the high tensile strength bolts and found them satisfactory. The paragraph on bolts was accepted as information, as was also the article on track drills.

The articles on ratchet track wrenches, simplified track jacks, insulated joints and tie tongs were accepted as read.

The article on a tie puller was accepted as information.

The subject of switch stands provoked considerable discussion, but finally was accepted as read, favoring the use of automatic switch stands.

The article on nut locks was accepted as information.

Some failures of bumping posts were cited, and the convention voted to add to the committee report: "We have found no car stopper which gives entire satisfaction."

The article on steel bunks was accepted after having endorsement from a number of the members.

USE OF POWER DRIVEN AND LABOR SAVING APPLIANCES.

This important subject is one that is now given considerable attention in the Maintenance of Way Department, and the use of power driven machinery for labor saving is increasing owing to the economical possibilities offered to further a saving in maintenance. In fact, the high cost of labor makes it imperative that this department of the railroad use all the labor saving or mechanical devices possible, where they can be applied to secure good results.

Within the limits of this topic are numerous devices which have been perfected to meet local requirements, many being capable of wider application, and your committee has endeavored in this paper to consider only such appliances as are available for more general use in the Maintenance of Way Department, showing their relative advantage over the older methods for similar work.

Section Motor Cars.

1. The use of section motor cars is considered by your committee an important development toward increase in efficiency.

2. There have been diverging views existing among some railroad men concerning the advisability of installing motor cars on sections and, while their use may not be equally advantageous in all territories, it is evident to your committee, after careful investigation and actual experience in the use of these power driven cars, that there is absolutely no doubt of the economy and advantages in their use.

3. These cars, where used, have resulted in a substantial saving in track maintenance not only from the fact that a greater territory may be covered by the same number of men formerly employed on the hand car sections, but because experience shows that greater efficiency and longer hours of work are secured; the men reach their work in a condition ready for duty; the service of work trains has been dispensed with, to a great extent, in the distribution of material and taking gangs to and from distant points, and men are collected quickly in emergency cases.

The power on these cars could also be made use of for such purposes as operating rail saws, drilling machines, putting in screw spikes, etc.

After becoming familiar with the motor car, the foremen are quick to recognize its merits and with the men give it their best support. Men are more readily secured on sections where these cars are operated.

Light repairs to these cars can be readily made by the foreman and it very rarely becomes necessary to shop the cars for repairs to the motor or parts. Their use may be abused, however, and excessive rate of speed and disregard of trains would sooner or later result in accidents and heavy repair cost. This difficulty is to be avoided by issuing and enforcing stringent rules as to the use and care of the cars.

4. Your committee urges the adoption of motor section cars and recommends their general use especially on portions of the road where the volume of traffic is not exceptionally heavy.

Gravel and Ballast Cars and Unloaders.

In the handling of large quantities of gravel or similar material, more especially on construction work, the use of specially designed cars with doors swinging upward permitting the use of a plow unloader, is an important factor as a labor saver. The unloader with a large size drum is placed on a flat car and operates the cable attached to the plow, the unloader being next to the locomotive from which is a steam pipe connection furnishing the power. A train of twenty cars can be unloaded by this machine in from ten to fifteen minutes.

Rail Loaders.

A power driven machine designed to load or unload rail and other heavy material is now very essential, and its use has proved its worth on account of its decided saving in labor, satisfactory manner of handling material without damage in an economical manner, and the increase in safety of operation.

The careful handling of rail is of great importance, especially the unloading of them from the high sideboard cars in which they now invariably reach the point where they are to be distributed. Rails when removed from these cars should be laid on the ground and not dropped from the car. To properly perform this work by hand requires a large force of men which, with the unavoidable delays, makes the operation a costly and frequently a dangerous method of handling such material, which has been decidedly increased in size and weight in the past few years while the inexperienced laborers now available are less intelligent and efficient.

There are various types of rail loaders used, although there appears to be no particular make of this device in universal use, and many railroads are still performing such work by hand labor.

While on some roads an ordinary light pattern steam derrick or crane is used to some extent, with satisfactory results, there is now on the market and in use by a number of roads, a rail loader operated by compressed air which has shown exceptional merit in the rapid handling of rail and other material. It is mounted on a covered flat car and consists of a demountable boom attached to a low mast and guyed to an adjustable "A" frame on each end of the car, which permits of the loading or unloading of two cars at the same time. The hoisting cables, which run along the booms, are attached to piston rods in the compressed air hoist cyclinders which are on the floor of the car and are connected with air reservoirs, air for this device being taken from the "train line." A "Loader" as above described with a force of nine men will load or unload rails at the rate of four per minute.

Stone Ballast Plow.

This machine, which is used for the purpose of loosening stone ballast in track centers preparatory to cleaning, will do the work of several hundred men with picks. It is permanently attached to a flat car and has rigid horizontal arms which may be extended from one end of the tie to the center line by air pressure. On these arms are carried plows which consist of tool steel spuds about 12 inches long, the section at the top being 3 inches across and 6 inches lengthwise with the track. The arms are raised and lowered by air pressure and are driven into the roadbed to a depth of several inches below the bottom of the tie if desired. The plow is moved at a speed of from five to six miles per hour.

Other Operations Using Compressed Air for Power.

Where there is a supply of compressed air at hand it has been found to be very satisfactory and economical to use it in cleaning the iron work from bridges, also in cleaning the bridge seats. The ordinary pressure hose is used with a nozzle and thumb valve. By this method one man can clean a bridge in a few hours where it would take five or six men the same time with brooms and brushes, and the results were much more satisfactory.

Pneumatic drills have been used to bore rails in track and around interlocking plants and it has been found that two men in two days would accomplish as much work of this nature as four men could perform with hand drills in four days.

1. Snow Handling in General.

Keeping the track, particularly the switches and interlocking apparatus, in a serviceable condition during severe snow storms, constitutes a heavy item of expense on the railroads of the northern states.

Large size snow plows are indispensable in cold climates, the rotary plow equipped with flangers proving most satisfactory. All snow car equipment should have the flangers operated by air taken from the track line.

2. Snow Handling in Important Yards.

In busy and complicated yards and terminals, where train movements are frequent, it is a physical impossibility to keep switches in an operative condition by the hand method of cleaning and the unskilled labor necessarily hired to assist in such emergencies does not and can not understandingly perform the duties required. Therefore, any labor saving appliance that will minimize the danger to the men and effectually keep switches in operation should receive earnest consideration.

From experience, it has been found that the hydro-carbon method of cleaning snow from switches is more effective than any other; the switches, intricate mechanism of interlocking, etc., in busy yards being kept in working order by the regular experienced forces during the heaviest snow storms.

This method consists of the melting of snow by pouring upon it ignited hydro-carbon oil, a volatile liquid comparable to gasoline. It is applied to switches by hand distributing cans which hold about three gallons. The cans have a long spout of three-eigths inch pipe and a valve. The opening at the end of the spout is one-thirty-second inch diameter and the spout is wrapped with asbestos for several inches from the end. This method is very efficient for removing snow from the intricate mechanism of interlockings, switches, slip crossings, etc., but for the simple removal of quantities of snow from hand operated switches it does not compare so favorably with the more common methods. About interlockings it is estimated that the efficiency of a man is increased two or three times by using the hydro-carbon cleaning method.

Ditching Machines.

It is practically impossible to write anything new on the importance of drainage to a roadbed and track, as efficient drainage has always been recognized as a fundamental requirement for good track work.

The method of ditching cuts by hand with a shovel is economical in shallow cuts, but where an extra large amount of deep ditching is to be performed, as is the case on many roads, a mechanical ditcher is found to be necessary as a labor saving device.

Miscellaneous.

1. In applying bolts, when renewing rail in main tracks, considerable time is gained by using short wrenches, about 8 inches long, by which a nut can be rapidly screwed up. These nuts are later tightened by men who follow with the long wrenches.

2. On stone ballast territory, canvas aprons are sometimes a part of the work train equipment and are used to cover the stone ballast shoulder when loading dirt from the ditch.

3. In distributing coal to stations, a sectional chute about twenty-four feet long, when extended, is very practical and affords a considerable saving in labor over carrying coal in bags.

4. When the right of way is of such a character as to allow of it, a very large percent of the cost of mowing can be saved by having farmers along the line mow with a horse-drawn mowing machine.

5. In districts where there is great liability of damage from fire spreading from the right of way, protection can be made by plowing a strip of land parallel to the track about ten feet wide some distance from the track.

6. It has been found good practice to raise the guard timber or log on highway bridges an inch or two, thus allowing the wind to sweep over the floor and keep it free from dirt, saving labor cleaning as well as protecting the plank to a certain extent from decay.

H. E. Astley, chairman, N. Y. N. H. & H.; Coleman King, L. I.; J. H. Anger, N. Y. C.; Z. B. Couch, L. & N.; J. W. Fletcher, Jr., Car. & N. W.; J. W. Powers, N. Y. C.; Robert Faries, Penn.

There was no discussion on this subject, due to lack of time

New Officers.

The election of officers resulted as follows:

President, A. F. Donahoe, general supervisor of road, B. & O. R. R.; first vice president, C. H. Gruver, roadmaster, C. R. I. & P. Ry.; second vice president, B. C. Dougherty, roadmaster, C. M. & St. P. Ry.; secretary and treasurer, L. C. Ryan, roadmaster C. & N. W. Ry. (re-elected).

J. P. McAndrews, roadmaster C. & N. W. Ry., was appointed a member of the board of directors.

Remembrance Token Presented to Captain Kidd.

A handsome reading lamp was presented to Captain and Mrs. Kidd by the members of the association, in token of the esteem in which he is held, and to indicate that the value of his constant and untiring support of the association is appreciated. A. M. Clough made the presentation speech in his inimitable way, and was answered and thanked in a few expressive words by Mr. and Mrs. Kidd.

Ladies' Auxiliary.

The members of the Ladies' Auxiliary were entertained in a liberal manner during convention week by the Track Supply Association. An automobile trip was enjoyed Wednesday afternoon, followed by a buffet luncheon and boat ride on the Lake Michigan Steamer "United States." This outing was thoroughly enjoyed by the large number present. Thursday afternoon the ladies attended a ball game between the Chicago and Brooklyn National League clubs. In the evening the ladies were tendered a theatre party at the Auditorium, where the melodrama "The Whip" was being played.

At the meeting of the Auxiliary, the officers were reappointed for the ensuing year.

Entertainment.

The members of the Roadmaster's Association were entertained on the boat ride Thursday evening, mentioned before. Preparations had been made by the Track Supply Association to take the entire membership, en masse, to the ball game Thursday afternoon. Owing to the pressure of the convention work, the president deemed it necessary that a session be held instead and the ladies attended the ball game in a party.

Thursday evening the annual banquet was tendered the roadmasters by the Track Supply Association. A. H. Weston, president of the Track Supply Association, acted as toastmaster. W. L. Park, vice president of the Illinois Central R. R., called attention to the fact that the railways need the co-operation and influence of all employes in molding public opinion against adverse railway legislation. He cited the fact that materials and labor are constantly becoming more expensive, and freight and passenger rates are decreasing or remaining stationary.

He deplored the snap judgment of those who advocate automatic control when the block signals fail, steel cars when a collision occurs, and automatic signals when a flagman fails in his duty, regardless of the fact that the railway may not be paying dividends. The rapidity of the change in from one cure to another makes it impossible to satisfy public opinion.

Mr. Park also called attention to the fact that a large amount of railway stock is now held in very small lots by thousands of shareholders, on many railroads. He called attention to the fact that such stockholders cannot be expected to forego dividends indefinitely.

H. R. Safford, chief engineer of the Grand Trunk Ry., spoke on Economics in Track Labor. He divided the economics of track labor into: (1) Study of track department organizations; (2) Study of working conditions; (3) Study of efficiency; (4) Evolving means of raising the efficiency; (5) Study of a correct comparison of conditions, to arrive at an equitable way of apportioning expenditures.

He said that too many of our methods and methods of organization were traditional, and that these should be analyzed to determine whether there is not a better way.

It is suggested that larger sections will be used on account of the difficulty in obtaining foremen. We do not know now whether we have an economical length of section or not. Compensation and environment are important divisions of the subject which should not be lost sight of.

He discussed the problem of developing foremen, giving his opinion that the apprentice system is a necessity. He also cited the advantages of meetings of foremen to broaden their views and experience by mutual expression of views.

Mr. Safford stated that he believed the subject of combined maintenance, or enlarging the scope of the section foreman's duties, was a question which would warrant the most careful study. Planning work to obtain the greatest advantage from its execution and therefore from the money spent, is being realized more and more to be very important.

The end of the fiscal year, occuring July 30, is a very disturbing influence on the economies of track labor, since it occurs right in the midst of the busy season, and frequently plays havoc by greatly reducing the forces when most needed.

James Burke, superintendent of roadway, bridges and buildings of the Erie R. R., stated that the efforts of track men and supply men alike were necessary in the improvement of road bed and track.

Other speakers of the evening were Wm. Shea, president of the Roadmaster's Association; past president, A. M. Clough, and W. C. Kidd, secretary of the Track Supply Association.

Aftermath.

Several dinners were given after the convention closed. One of these was attended by Henry Fisher, E. M. Fisher, Mr. and Mrs. L. C. Ryan, Mr. Johnson, (P. & M. Co.), Dave Hallberg and Mr. and Mrs. W. C. Kidd. At this dinner Captain Kidd was presented with a beautiful mahogany table on which to place the lamp presented by the Roadmaster's Association. E. M. Fisher overcame his proverbial modesty and presented the token with an appropriate presentation speech. Captain Kidd was non-plused by this additional token of regard, but thanked the donors heartily.

The American consulate general at Rio de Janeiro, Brazil, states that tenders will be received until October 31 for constructing a railway over a range of mountains from Piquete, in the State of Sao Paulo, to Itajuba, in the State of Minas Geraes. American contractors desiring to submit tenders for this contract must do so through a local representative and deposit as guaranty about $7,000. Conditions under which this road will be built can be obtained from the Bureau of Foreign and Domestic Commerce.

Personals

Although we are publishing monthly in these columns a practically complete report of all appointments of interest to our readers, it is probable that this information could be published earlier if each subscriber would make it his business to notify us of new appointments immediately. We request and we shall appreciate your assistance in this respect.

J. P. Costello, formerly supervisor of road on the *Baltimore & Ohio R. R.*, has been appointed roadmaster of the *Atchison, Topeka & Santa Fe Ry.*, Western lines, at Pueblo, Colo., vice L. Bradley.

G. A. Argenbright supervisor of road of the *Baltimore & Ohio R. R*, has been transferred from New Martinsville, W Va., to Lodi, O. M. F. Heany has been appointed supervisor of road at Connelsville, Pa. G. W. Huffman has been appointed supervisor of road at Rowlesburg, W. Va. L. D. McCullough has been appointed supervisor of road at New Martinsville, W. Va.

W. A. Bump, formerly bridge inspector, has been appointed assistant supervisor of the *Boston & Albany R. R.* at Springfield, Mass., succeeding F. S. Austin, appointed track supervisor at Palmer, Mass. F. P. Morrill has been appointed assistant supervisor at Boston, Mass., succeeding S. H. Wilson. C. E. Taylor, track supervisor, has been transfered from Palmer to Boston, Mass.

William Kersey has been appointed roadmaster of the *Caro Northern Ry.*, at Caro, Tex., succeeding S. C. Burgess.

H. McDonald has been appointed roadmaster of the *Central Vermont Ry.* at Farnham, Que., succeeding D. A. Wallace.

E. Leaon, roadmaster of the *Chicago Great Western R. R.*, has been transferred from Council Bluffs to St. Paul, Minn., succeeding C. Algren.

August Shoemaker has been appointed roadmaster of the *Chicago, Milwaukee & St. Paul Ry.* at Western Ave., Chicago, Ill.

A. D. Millard has been appointed roadmaster of the *Chicago, Peoria & St. Louis R. R.* at Springfield, Ill., succeeding J. R. Holliday.

R. R. Blair, roadmaster of the *El Paso & South-Western System*, has been transferred from Duran to Alamagordo, N. M., succeeding F. W. Taylor. F. M. Davis succeeds Mr. Blair as roadmaster at Duran, N. M.

W. H. Haynes has been appointed supervisor of the *Grand Rapids & Indiana Ry.* at Cadillac, Mich. He succeeds J. H. Whalen, who has been transferred to Grand Rapids as supervisor in place of C. J. Shannessy, appointed special agent, Grand Rapids.

Ed. Donley has been appointed assistant roadmaster of the *Great Northern Ry.* at Allouez, Wis., succeeding J. Madsen. C. A. Hanson has been appointed assistant roadmaster at Essex, Mont., succeeding J. Kayamore. A. L. Ketcham, assistant roadmaster, has been transferred from Billings to Judith Gap, Mont. A. T. Manley has been appointed assistant roadmaster at Rexford, Mont., succeeding A. Larson, appointed roadmaster. A. Newbery has been appointed assistant roadmaster at Moorhead, Minn., succeeding N. A. Johnson. C. Raiter, assistant roadmaster, has been transferred from Tintah to Breckenridge, Minn. C. Rask has been appointed assistant roadmaster at Casselton, N. D., succeeding A. Parke. S. C. Roper has been appointed assistant roadmaster at Grand Forks, B. C. J. L. Sheely has been appointed assistant roadmaster at Devil's Lake, N. D., succeeding C. E. Weaver, promoted. J. M. Woodson, formerly supervisor, has been appointed assistant roadmaster at Corinth, Miss. W. H. Purcell has been appointed supervisor at Fulton, Ky., succeeding Mr. Woodson. J. E. Rogan has been appointed supervisor at New Orleans, La. T. F. Donahue has been appointed supervisor at Cherokee, Ia., succeeding L. M. Gunstead, transferred to Waterloo, Ia. B. Gilleas has been appointed supervisor at Carbondale, Ill., succeeding J. F. Plott, transferred.

W. C. Costigan, roadmaster of the *Illinois Central R. R.*, has been transferred from Water Valley, Miss., to Chicago, Ill., succeeding D. W. Thrower. R. L. Hazelgrove, formerly assistant roadmaster, has been appointed roadmaster at Water Valley, Miss., succeeding W. C. Costigan, promoted. J. F. Plott, formerly supervisor, has been appointed roadmaster at Carbondale, Ill., succeeding J. C. Clifford, promoted. J. F. Watts, formerly supervisor, has been appointed roadmaster at New Orleans, La., succeeding C. E. Weaver, promoted. T. F. Donahue has been appointed supervisor of the *Illinois Central R. R.* at Cherokee, Ia., succeeding L. M. Gunstead, transferred to Cherokee, Ia. B. Gilleas has been appointed supervisor at Carbondale, Ill., succeeding J. F. Plott, transferred.

B. D. King has been appointed roadmaster of the *Lake Erie & Western R. R.* at Lima, O., succeeding J. R. Coulston.

W. L. Hesterly has been appointed roadmaster of the *Louisiana Western R. R.* at Lake Charles, La.

W. R. Wagoner has been appointed roadmaster of the *Minneapolis, St. Paul & Sault Ste. Marie R. R.* at Abbotsford, Wis., succeeding Edward Johnson.

J. H. Haworth has been appointed roadmaster of the *Missouri & North Arkansas R. R.*, office at Harrison, Ark. W. H. De Witt, supervisor, has been transferred from Leslie to Harrison, Ark. J. C. Francis, supervisor, has been transferred from Georgetown to Searcy, Ark. Pete Henson has been appointed supervisor at Harrison, Ark.

F. W. Kahlmus, formerly supervisor, has been appointed assistant roadmaster of the *Mobile & Ohio R. R.* at Cairo, Ill. C. W. Gannon has been appointed supervisor at Murphysboro, Ill., succeeding Mr. Kahlmus.

J. B. King has been appointed roadmaster of *Morgan's Louisiana & Texas R. R.* at New Iberia, La., succeeding S. Collen.

F. X. Soete, formerly assistant engineer, has been appointed roadmaster of the *New York, Ontario & Western Ry.* at Walton, N. Y.

D. S. Jones, supervisor of the *Norfolk Southern R. R.*, has been transferred from Norfolk, Va., to Plymouth, Va. J. B. Yates has been appointed supervisor at Raleigh, N. C., succeeding K. G. Davis.

H. J. Davall, formerly assistant supervisor, has been appointed supervisor of the *Pennsylvania R. R.* at Oil City, Pa., succeeding T. F. Hilliard, assigned to special duties. A. W. Duke, formerly transitman, has been appointed assistant supervisor at Osceola Mills, Pa., succeeding C. M. Hursh, transferred.

W. F. Bushroe, roadmaster of the *Pere Marquette R. R.*, has had his territory extended and his office moved to Plymouth, Mich.

Clarence M. Hursh, formerly assistant supervisor of the Pennsylvania R. R., has been appointed assistant supervisor of the *Philadelphia, Baltimore & Washington R. R.* at Wilmington, Del.

E. Abrahamson, roadmaster of the *St. Louis & San Francisco R. R.*, has been transferred from Lawton to Oklahoma City, Okla. M. Curry, roadmaster, has been transferred from Sapulpa to Antlers, Okla., succeeding J. Healy, transferred. M. Duncan, roadmaster has been transferred from Francis to Hugo, Okla., succeeding John Ladin, transferred. P. H. Hamilton has been appointed roadmaster at Memphis, Tenn., succeeding A. R. Van Zant. J. Healy, roadmaster, has been transferred from Antlers to Sapulpa, Okla., succeeding M. Curry, transferred. John Ladin, roadmaster, has been transferred from Hugo to Francis, Okla., succeeding M. Duncan, transferred. J. J. Phayer, roadmaster, has been transferred from Cape Girardeau to Chaffee, Mo. L. Ramey, roadmaster, has been transferred from Kennett to Cape Girardeau, Mo., succeeding J. J. Phayer, transferred.

M. A. Self has been appointed roadmaster of the *Seaboard Air Line Ry.* at Jacksonville, Fla., succeeding B. J. Fort.

P. C. Connelly has been appointed general roadmaster of the *Western Pacific Ry.* at Oakland, Cal.

C. J. Harrington has been appointed supervisor of the *Yazoo & Mississippi Valley Ry.* at Greenville, Miss., succeeding W. J. Marshall.

W. A. Battles has been appointed roadmaster of the *Wichita Falls Route* at Wichita Falls, Tex., succeeding P. Sweeney. J. F. Montgomery has been appointed roadmaster at Woodward, Okla., succeeding T. Potter.

ROADMASTER'S SON TAKES PRIZE.

We produce herewith, a photograph of Andrew H. Fiala, Jr., the 15 month old son of Mr. and Mrs. Andrew Fiala, Willmar, Minn. A. H. Fiala is roadmaster at Willmar, Minn., on the Great Northern Ry., with which company he has been connected for 22 years. Andrew Fiala, Jr., took first prize in the Baby Health Contest of the Minnesota State Fair, held Sept. 1 to 6, 1913; he weighs 94.9 lbs., and prospects are he will make a bouncer of a railroad man some day.

ANDREW FIALA, Sr., and Jr.

"Good-bye" tickets, price one penny each, will be on sale this morning at the Waterloo South Side Station.

The London and South-Western Railway Company has decided to levy a tax on the lovers, friends and relatives who come to kiss the company's passengers and shout "Don't forget to write" through the carriage windows of departing trains.

On and after today fond farewells will be one penny each, with no reduction for family parties.

So far as platforms Nos. 1, 2, 3, 4 and 5 are concerned, any one who wants to make sure that his friends really do leave town will have to place a penny in an automatic machine, and so purchase a good-bye ticket.

This cardboard slip will enable him to travel the full length of the company's platform, the return journey to be completed during the same day. This is a very busy part of the station, and it is calculated that for an expenditure of twopence one will be able to "see off" as many as fifty-five trains during the course of an afternoon.

On all the north side platforms good-byes may still be said free of charge.

The new ticket machines were on view yesterday. They are tall, suffragette-proof erections, colored an amazing vermillion, and they promise in black and white to return the penny if there happen to be no good-bye tickets in stock.

The system has been adopted at some of the principal stations or the North-Eastern Railway Company.—The Daily Express, London.

ABUTMENTS—HELL GATE ARCH SPAN.

The massive concrete tower abutments of the 977 ft. 6 in. steel arch span of the Hell Gate Bridge of the New York Connecting R. R. will be 250 ft. in height above mean low water level. They will have a section of 140 x 104 ft. at the base and 100 x 75 ft. above the base. These towers 1,087.5 ft. with centers apart will carry the largest arch span in the world, 145 ft. deep at skewback and 45 ft. at the crown, designed for four tracks with two 860,000-lb. locomotives and a following load of 6,000 lbs. per linear foot on each track. The foundation for the tower at the Long Island end is carried down to bed rock 25 ft. below the surface, and is complete. The foundation for the Ward Island tower, now under construction, will consist of caissons sunk 150 ft. to bedrock. These caissons are of reinforced concrete sunk by open excavation and by pneumatic caisson work where necessary. The towers will have an architectural treatment in keeping with the massive structure they support and will no doubt be quite artistic.

A great amount of concrete will also be used in the other bridges and viaducts which, together with the arch span just described, will form a bridge with a total length of 15,840 ft., making it the longest in the world. Four hundred fifty thousand cu. yds. of concrete and 90,000 tons of steel will be required for this work. Mr. Gustav Lindenthal is chief engineer and designer and is in charge of construction. Work has been in progress since July, 1912.

With The Manufacturers

New Literature

Hubbard & Co., Pittsburgh, has recently issued a very attractive and distinctive new catalogue of track tools. The entire book containing 140 pages, is made up entirely of blue line prints, showing several views of each tool. All dimensions are shown on each tool, and the weight and other pertinent information is given. Every trackman should have one of these catalogues.

* * * * *

Peerless Electrical Measuring Instruments are described and illustrated in a high class catalogue issued by the Thompson, Levering Co., Philadelphia. A detailed description, accompanied by an illustration of the following apparatus is given: Peerless switch dial testing set (ordinary size and large size); government standard portable testing set; Peerless plug set; Peerless improved fault finder; Peerless inductive fault finder; Peerless portable cable testing outfits; Peerless galvanometer and artificial lines and cables. Any signal man or superintendent of telegraph may obtain a copy of this catalogue on request.

The Railway Appliances Co., West Street Bldg., New York City, has issued a pamphlet describing, illustrating, and giving weights and data on Fewings wrecking frogs. The construction of this device, of which there are five sizes for various heights of rails, is fully shown. The operation of the frogs is also explained and illustrated.

* * * * *

The Elyria Iron & Steel Co., Elyria, O., has issued a circular which illustrates the Manhattan Compromise Rail Joint, base supporting, a device recently taken over by this concern. Side and bottom views of two types of rail joints are given, one for an ordinary T or steam railway rail, the other showing a girder or street railway rail. This joint, as shown in the illustration, is of exceptionally rugged construction.

* * * * *

Bulletin 148, of the Chicago Pneumatic Tool Co., describes hand drills and portable compressors. It is gotten out in the usual neat and attractive form in which this company's literature appears. There are a number of excellent illustrations and some data on drilling records which should be of value to those engaged in the use of drills.

NEW OFFICERS, TRACK SUPPLY ASS'N.

Walter H. Allen, appointed president of the Track Supply Association, was born and educated in Philadelphia, and became interested in railway work in 1902, when he was employed by a contractor as assistant manager of the Commissary Department at Enolo Yard, Harrisburg, Pa. He entered the service of the Pennsylvania Steel Co. in 1904, serving for two years in the office and shops. He was appointed division engineer in 1908 and moved to his present address, Toledo, late in the fall of that year.

Mr. E. M. Fisher, appointed vice president of the Track Supply Association, has been connected with Fairbanks, Morse & Co., of Chicago, for the last 10 years. During these years he has been constantly in the sales department and has represented this company successfully in the cities of New York, Philadelphia, and Detroit. He is now located at Chicago, and is in the railway sales department.

W. C. Kidd, re-appointed secretary and treasurer of the Track Supply Association has been connected with the Ramapo Iron Works for so many years that no one seems to know when he entered the employ of this company. It is almost needless to state that he is sales representative of this concern among track men.

Henry Fisher, appointed a member of the Board of Directors of the Track Supply Association, began his railway career in 1900, on the Big Four Ry. From 1900 to 1904 he was on construction work. He was later appointed accountant and subsequently chief clerk to the chief engineer of the Big Four Ry. In 1911 he became connected with the Ramapo Iron Works as sales representative, his present headquarters being in the Karpen Bldg., Chicago.

L. P. Shanahan, elected a member of the Board of Directors of the Track Supply Association, has been connected with the American Steel & Wire Co. for a number of years, in fact, practically his first work of any kind having been done in their employ. For the last nine years he has been railway sales manager. Previous to this he held various positions in the sales department and sub-departments.

The New York, New Haven & Hartford is carrying out improvements at Woonsocket, R. I., to include a new yard covering 10 acres of land, to have 19 tracks; also a new outbound freight house 30 ft. x 400 ft., and an inbound freight house 60 ft. x 400 ft. A two story brick office building is also included in the improvements. Work on the freight house is nearing completion.

ANNUAL EXHIBIT, TRACK SUPPLY ASS'N.

The exhibit of the Track Supply Association occupied a large hall adjacent to the Roadmaster's Association convention hall. This space not being sufficient, a number of rooms adjoining this hall were also occupied. The exhibit was the largest and most interesting ever held by the Track Supply Association, the affairs of which are in a gratifying condition.

The annual meeting was held Thursday morning, September 11. The election of officers resulted as follows:,

President, Walter H. Allen, Pennsylvania Steel Co.; vice president, E. M. Fisher, Fairbanks Morse & Co.; secretary-treasurer, W. C. Kidd, Ramapo Iron Works (re-elected).

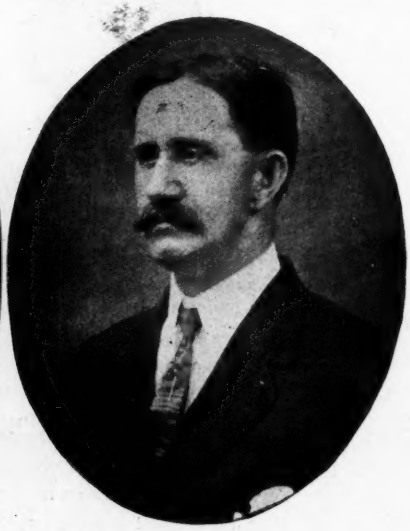
Henry Fisher, Verona Tool Works, and L. P. Shanahan, American Steel & Wire Co., were elected members of the board of directors.

Following is the list of exhibits and exhibitors:

Ajax Forge Co., Chicago—Manganese guard rails. Representatives, F. B. Bradley, H. G. Elfborg and H. C. Hutchins.

WALTER ALLEN, Pennsylvania Steel Co.
President Track Supply Ass'n, 1913-14.

E. M. FISHER, Fairbanks, Morse & Co.
Vice Pres., Track Supply Ass'n, 1913-14.



W. C. KIDD, Ramapo Iron Works.
Sec. and Treas., Track Supply Ass'n, 1913-14.

American Hoist & Derrick Co., St. Paul, Minn.—Transparency views of the American railroad ditcher. Representatives, E. Coleman and C. C. Austin.

American Steel & Wire Co., Chicago—American railroad fencing, galvanized steel fence posts. Representatives, L. P. Shanahan, J. W. Collins, C. W. Boon and B. B. Ayers.

American Valve & Meter Co., Cincinnati, Ohio.—Economy switch and interlocking stands, safety locks. Representatives, J. P. McGarry and F. C. Anderson.

Associated Manufacturers' Co., Waterloo, Iowa.—Jerry Boy hand car engine. Representative, A. H. Ambrose.

Beaver Dam Malleable Iron Co., Beaver Dam, Wis.—Malleable iron tie plates and rail braces. Representatives B. P. Lamoreux and F. B. Bell.

Barr, James C., Boston, Mass.—Brown rail loader and unloader. Representatives, James C. Barr and Robert H. Anthony.

Blessing, Louis, Jackson, Mich.—Reinforced concrete tie, rail clamps and continuous rail joint. Representative, Louis Blessing.

Carnegie Steel Co., Pittsburgh, Pa.—Automatic stereopticon showing pictures of steel tie track; section of steel tie with new fastening, and Duquesne angle bar. Representatives, M. M. Hench and Robert Coe.

Chicago Pneumatic Tool Co., Chicago.—Rockford motor cars. Representatives, J. C. Camel and J. L. Canby.

Commercial Acetylene Railway Light & Signal Co., New

York City.—Flashing and steady acetylene signal lights. Representative, H. G. Doran.

Crerar, Adams & Co., Chicago.—Calumet drills, Eureka bonding drills, new track shovel of vanadium steel. Representatives, Russell Wallace, G. D. Bassett, J. A. Martin and C. O. Swift.

Economy Separable Switch Point Co., Louisville, Ky.—Economy switch points and claw bars. Representatives, W. M. Mitchell, J. A. Shoulty, J. R. Long, J. R. Montgomery and L. C. Ferguson.

Elliot Frog & Switch Co., East St. Louis, Ill.—Switch stands. Representatives, H. Elliott and W. J. Fairback.

Fairmont Machine Co., Fairmont, Minn.—No. 1 motor car, roadmasters' inspection car and 5-h. p. engine for section cars. Representatives, F. E. Wade and H. E. Woolery.

Fairbanks, Morse & Co., Chicago.—Motor cars. Representatives A. A. Taylor, F. N. Whitesell, E. M. Fisher, D. J. Higgins, L. H. Mathews, E. C. Golloday and L. Norvell.

Frictionless Rail, The, Boston, Mass.—Representatives F. A. Barbey, S. W. Simond and G. H. Bryant.

Haggard & Marcusson, Chicago.—"Tiger" steel bunks. Representatives, H. H. Marcusson and E. A. Sammons.

HENRY FISHER, Verona Tool Works.
Member of Board, Track Supply Ass'n.

Hall Switch & Signal Co., New York City.—Signal appliances. Representatives, W. J. Gillingham, Jr.

Hayes Track Appliance Co., Richmond, Ind.—Hayes derails. Representatives, E. L. Ruby and S. W. Wallace.

Hobart-Allfree Co., Chicago.—Derailers and car replacers. Representatives, W. H. England, E. H. Allfree and F. R. Cooper.

Joyce-Cridland Co., Dayton, Ohio.—Track and bridge jacks Representatives, C. D. Derby and W. I. Crock.

Kelly-Derby Co., Chicago.—Rail braces and rail relaying machine. Representatives, C. W. Kelly, R. E. Derby and W. B. Holcomb.

Keystone Grinder & Mfg. Co., Pittsburgh, Pa.—Tool grinders. Representative, Wm. L. Munk.

Lackawanna Steel Co., Buffalo, N. Y.—Tie plates and rail joints. Representative, A. H. Weston.

M. C. B. Co., Chicago.—Dinklage creek check and Conley frogs. Representatives W. E. Marvel, F. A. Buckley and C. R. Westcott.

Mudge & Co., Chicago.—Mudge-Adams inspection car and engine equipment for section cars. Representatives, R. M. Smith, R. D. Sinclair, J. I. Winchell and G. W. Bender.

National Lock Washer Co., Newark, N. J.—Nut locks. Representatives, John D. Seymour and Alvin T. Thompson.

National Malleable Castings Co., Cleveland, Ohio.—Tie plates, rail braces, anchors, combination tie plate, rail brace, and anti-creeper. Representatives, James L. Pray, J. J. Byers, C. H. McCrea, C. L. Johnson and W. B. Bellman.

Northwestern Motor Co., Eau Claire, Wis.—Casey-Jones hand car engines. Representatives, K. Rosholt and R. R. Rosholt.

P. & M. Co., The, Chicago.—Rail anchors. Representatives, F. A. Preston, Philip W. Moore, D. T. Halberg, A. R. Sutter, L. S. Walker, J. W. Dodge, Jr., and George E. Johnson.

Positive Nut Lock & Tie Co., Grand Rapids, Mich.—Positive nut lock. Representative, M. M. Goble.

Positive Rail Anchor Co., Louisville, Ky.—Positive rail anchors and Betts anti-creeper tie plate. Representatives W. M. Mitchell, J. A. Shoulty, John R. Long, J. R. Montgomery and L. C. Ferguson.

Q. & C. Co., The, New York City.—Vaughan rail anchors, Bonzano rail joints, guard rail clamps and rail anchor testing machine in operation. Representatives, A. E. Stokes, J. A. Bodkin, C. D. Woolworth and J. V. Westcott.

Pennsylvania Steel Co., Steelton, Pa.—Model 60-A shearable pin new Century switch stand, Model 50-A new Century switch stand, Mayari steel, heat treated, "never-turn" bolts. Representatives, Walter H. Allen, Fred H. Ogden, Geo. K. Reel and J. Drew Allen.

Rail Joint Co., New York City.—Rail joints. Representatives, H. C. Holloway, W. E. Clark, Chas. Jenkinson, Fred A. Poor, R. W. Smith and E. A. Condit, Jr.

Railroad Supply Co., Chicago.—Wolhaupter shoulder flange. Representatives, E. H. Bell, H. J. Van Nostrand, M. J. Cumerford, F. C. Webb and A. H. Smith.

Ramapo Iron Works, Hillburn, N. Y.—Switch stands, manganese switch points, rolled steel shoulder friction plate, and guard rail clamps. Representatives, W. C. Kidd, T. E. Akers and Arthur Germunder.

Sellers Manufacturing Co., Chicago.—Tie plates. Representatives, J. M. Sellers, R. A. Van Houten and G. M. Hogan.

Southern Railway Supply Co., St. Louis, Mo.—Saunders' car stopper. Representatives, M. E. Towner, W. D. Achuff and D. R. Saunders.

Templeton-Kenly & Co., Chicago.—Simplex jacks. Representatives, W. B. Templeton, A. E. Barron and A. C. Lewis.

U. S. Wind Engine & Pump Co., Batavia, Ill.—Switch stands and semaphores. Representatives, C. E. Ward and L. E. Welcott.

Union Switch & Signal Co., Swissvale, Pa.—Keystone insulated rail joints. Representatives, J. J. Cozzens and J. D. Roett.

Verona Tool Works, Pittsburgh, Pa.—Complete set of track tools. Representatives, Henry Fisher, Rex Gay and E. Woodings.

Whall, C. H., & Co., Boston, Mass.—Whall's special railroad fiber. Representative, C. H. Whall.

William Wharton, Jr., & Co., Inc., Philadelphia, Pa.—Manganese steel guard rail and brace, combination rail and tie plates, guard rail clamp, anti-creeper, switch stand. Representatives R. C. McCloy, G. R. Lyman, J. R. Bolgiano and F. R. Schaefer.

The Northern Pacific will construct a $100,000 steel bridge over the waterway at Tacoma, Wash., from Pacific avenue to Seventeenth street.

The Pennsylvania has prepared plans for a new freight station to be built at Harrisburg, Pa.

The Philadelphia & Reading has asked bids on about 900 tons of steel for track elevation at Olney, Pa.

The Susquehanna & New York has let the contract for car shops, 80 x 100 ft., one story, to be erected at Williamsport, Pa.

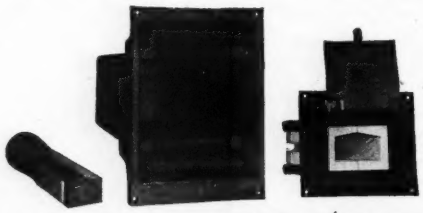
The Toledo & Ohio Central has awarded contract for the constructing an overhead crossing at Parsons avenue, Columbus, Ohio, to Frit, Runner, Grant, Cooke Co., of Columbus, at about $100,000.

NO. 2 AND NO. 3 RALCO RECEPTACLE AND PLUG.

The No. 2 and No. 3 receptacles and plugs, No. 2 illustrated herewith, were designed to meet the demand for a thoroughly reliable, heavy duty receptacle and plug for portable motors in shops, hotels, garages, office buildings and other places where portable machinery is used. They are especially desirable for portable drills, riveters, grinders, vacuum cleaners, elevators and battery charging. The No. 3 is the same design except it is for 60 amperes.

The receptacle consists of two heavy porcelain blocks fitted with heavy phosphor bronze spring contacts. The receptacles are mounted in an outer heavy cast iron case on an angle, to facilitate the insertion and withdrawal of the plug when installed upon a flat surface.

The case for the No. 2 is fitted with D. & W. cutout No. 91102, while the No. 3 is fitted with D. & W. cutout No. 91108.



No. 2 and 3 Ralco Receptacle and Plug.

The plugs are non-reversible and are especially desirable for battery charging and other work where this feature is required and where the apparatus should be protected by fuses.

Data—No. 2 Ralco Receptacle and Plug.

Capacity—30 amperes, 220 volts.

Plugs bored to take any size Okonite Reinforced Portable Cord up to and including No. 8 B. & S. gauge.

Data—No. 3 Ralco Receptacle and Plug.

Capacity—60 amperes, 220 volts.

Plugs bored to take any size Okonite Reinforced Portable Cord up to and including No. 4 B. & S. gauge.

No. 2 and No. 3 Ralco receptacles and plugs as well as No. 1 and No. 4 are approved by the Underwriters' Laboratories, Incorporated. They are handled by the Central Electric Co., Chicago.

Industrial Notes

Mr. C. C. Bradford, formerly manager of the Cleveland branch office of the U. S. Light & Heating Co., has been appointed sales manager of this company, with offices at 30 Church street, New York City.

Mr. Bradford became identified with the U. S. Light & heating Co. in 1909. After one year as manager of the New York branch office, he went to Cleveland for the purpose of establishing a branch office in that city. His appointment to sales manager comes after three highly successful years as manager of the Cleveland office.

About the affairs of the U. S. Light & Heating Co. Mr. Bradford has the following to say: "The U. S. Light & Heating Co. has experienced a most wonderful and rapid growth since it was organized four years ago and is today without a doubt one of the leading factors in the manufacture of specialized electrical apparatus, namely, storage batteries, electric starters and electric train lighting devices.

Considering the already tremendous demand for apparatus in all our lines, and the fact that this demand is increasing rapidly, I believe one is thoroughly justified in predicting that the growth of our company in the future will be even more gratifying than it has been in the past."

Mr. R. B. Clark has been appointed acting manager of the Cleveland branch office of the U. S. Light & Heating Co., manufacturers of U-S-L storage batteries, electric starter and lighter and electric train lighting equipments, succeeding Mr. C. C. Bradford, promoted.

C. C. BRADFORD, Sales Manager
U. S. Light & Heating Co.

STATEMENT AS TO THE OWNERSHIP AND MANAGEMENT OF THE RAILWAY ENGINEERING AND MAINTENANCE OF WAY, IN ACCORDANCE WITH ACT OF CONGRESS, AUGUST 24TH, 1912.

Railway Engineering and Maintenance of Way is published monthly at 431 South Dearborn St., Chicago, Ill.

The officers are as follows:

President—William E. Magraw, 431 So. Dearborn St., Chicago.
Editorial Director—L. F. Wilson, 431 So. Dearborn St., Chicago.
Editor—K. L. Van Auken, 431 So. Dearborn St., Chicago.
Business Manager—C. C. Zimmerman, 431 So. Dearborn St., Chicago.
Publisher—The Railway List Co., 431 So. Dearborn St., Chicago.

Those holding stock to the amount of one per cent or more are as follows:

W. E. Magraw, 431 So. Dearborn St., Chicago.
C. S. Myers, 50 Church St., New York.
H. H. Schroyer, 38 So. Wabash Ave., Chicago.
C. A. Dunkleberg, Ft. Wayne, Ind.
E. C. Price, Springfield, Ohio.
H. U. Morton, 140 So. Dearborn St., Chicago.
J. S. Bonsall, 26 Cortlandt St., New York.
G. H. Williams, Rockefeller Bldg., Cleveland, Ohio.
P. S. Smith,, 434 So. Green St., Chicago.
J. T. McGrath, Bloomington, Ill.
K. L. Van Auken, 431 So. Dearborn St., Chicago.
J. M. Crowe, House Bldg., Pittsburgh, Pa.
L. F. Wilson, 431 South Dearborn St., Chicago.
O. W. Middleton, 431 So. Dearborn St., Chicago.
B. H. Peck, 5210 North Lincoln St., Chicago.
Chas. Oliff, 831 So. Winchester Ave., Chicago.
A. R. Gould, Lambertville, N. J.
J. E. Chisholm, Old Colony Bldg., Chicago.

Those holding bonds to the amount of one per cent or more are as follows:

W. F. Hall Printing Co., 446 W. Superior St., Chicago.
Cozzens & Beaton, 443 Plymouth Court, Chicago.
Bradner Smith & Co., 175 W. Monroe St., Chicago.
Harry C. Lewis, New York, N. Y.
Geo. H. Holt, 431 South Dearborn St., Chicago.
Myron C. Clark Publishing Co., 612 So. Dearborn St., Chicago.
Mrs. Jessy Hazleton, 446 W. Superior St., Chicago.

(Signed)
WILLIAM E. MAGRAW, PRESIDENT.

Sworn to and subscribed before me this 26th day of September, 1913.
(Signed) Robert R. Grieg.
(My commission expires Oct. 26, 1915.) Notary Public.

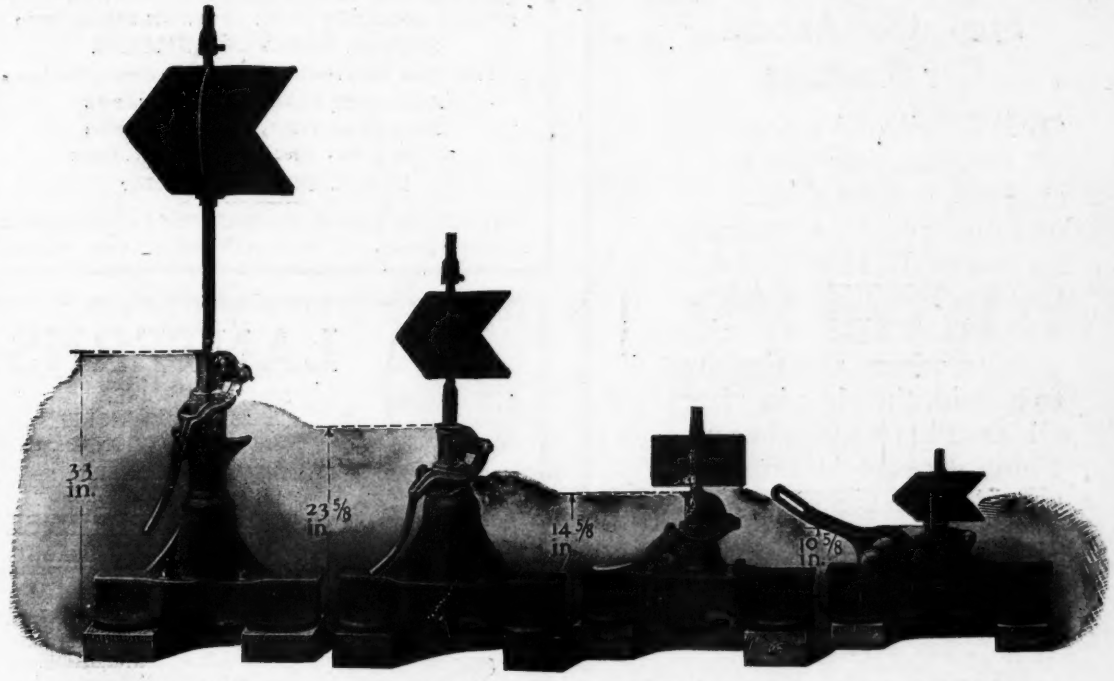
The San Luis Central, it is reported, was recently opened for business from Monte Vista, Colo., north to Center, 14 miles.

The Tennessee Western, it is reported, has track laying under way and Lacy McDowell & Co., the contractors, are laying a mile of steel a day on the line from Iron City to Collinwood, Tenn., about 18 miles.

The United Freeland Development & Tunnel Co. has been incorporated in Colorado with a capital of $2,000,000 to operate in Clear Creek county, Colorado.

The Winnemucca Northern, Winnemucca, Nev., will complete a location survey from Winnemucca, Nev., to Homedale, Idaho, by October 15. Surveying crews are now within 30 miles of the latter place. Definite plans as to construction have not been made.

R A M A P O



STYLE No. 17 STYLE No. 18 STYLE No. 19 STYLE No. 20

RAMAPO PATENT SAFETY SWITCH STANDS

1. **POSITIVE THROW.**—Ramapo Safety Switch Stands are rigid for hand operation. The operator raises the handle, thereby releasing the spindle from the automatic mechanism, then throws the switch, but cannot lower the handle or relock switch, unless the points are fully thrown.
2. **AUTOMATIC SAFETY FEATURES.**—A train or car can trail through a switch when set wrong locked with a Ramapo Safety Switch Stand, without breaking the switch points or injuring the switch stand. The first pair of wheels forces the switch points open compressing springs in the switch stand, and when points are half way thrown the springs snap the points the rest of the way. The stand is left locked in new position, just as if thrown by hand and is again ready for either hand or automatic operation.
3. **ADJUSTABLE FEATURES.**—All Ramapo Safety Switch Stands are furnished with adjustable throw and adjustable moving rods, unless otherwise ordered. Adjustable switch rods are not required as either switch point can be adjusted. The throw can always be adjusted to suit that of any switch, one-half turn of the eye bolt crank affecting the throw one-twelfth of an inch. See table of crank adjustments below. The distance of stand from switch can be readily adjusted with the adjustable moving rod without moving the stand on the ties.

CRANK ADJUSTMENTS FOR RAMAPO SAFETY SWITCH STANDS

THROW OF STAND	"A"		THROW OF STAND	"A"
3½"	2 5/12"		4½"	3"
3⅝"	2 1/16"		4⅝"	3 1/12"
3¾"	2 1/12"		4¾"	3 1/16"
3⅞"	2¾"		4⅞"	3 3/12"
4"	2 7/12"		4¾"	3 11/12"
4⅛"	2 15/16"		4⅞"	3 7/16"
4¼"	3"		5"	3 11/12"

EDISON-BSCO
Type 401 Cell, complying with RSA Specifications.

EDISON BSCO PRIMARY BATTERY

For Track Circuits

The Standard Closed Circuit Cell

Renewing batteries in cold weather is so expensive and difficult an operation that signalmen plan, as far as possible, for the work to be done in mild weather.

In the branches of signaling where EDISON-BSCO battery is used, it is a comparatively easy matter to arrange the renewal schedule satisfactorily, owing to the uniformly long and dependable life of each cell.

The difficulty of procuring water in northern latitudes during the winter, and the fact that battery wells or chutes must frequently be dug out of the snow, makes for costly maintenance. Freezing temperature is not conducive to highest efficiency, in connection with the process of recharging; from every standpoint Winter renewing is unsatisfactory and to be avoided if possible.

Prior to the use of the Edison battery for feeding track circuits it was not possible to restrict all battery work to seasonable weather on account of the gravity cell not possessing the required characteristics for delivering current for long periods without attention. The result of many track circuit tests conducted by various railroads show conclusively that cold weather recharging can be entirely eliminated by the use of EDISON-BSCO cells.

EDISON-BSCO cells have been thoroughly tested in track service for the past two years and have demonstrated that a life of from six months to one year (depending on traffic and number of cells used) can be obtained on the average circuit, that the uniform voltage maintained by the cell makes for reliable operation of the relay and the ability of the cells to discharge at high rates largely overcomes the liability of failure on circuits where the leakage is high.

Catalog, Voltage Curves or Estimates on Request

The cheapest form of battery energy

TRADE MARK
Thomas A Edison

EDISON-BSCO
Complete Renewal.

Thomas A. Edison, Inc.

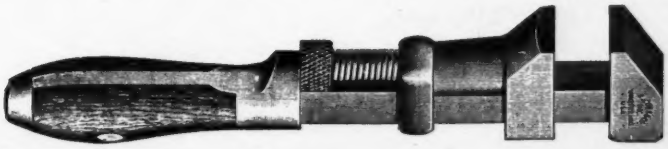
248 Lakeside Ave. **Orange, N. J.**

THE RELIGION OF A RUSTY NUT IS SUMMED UP IN THE WORD STUBBORNNESS

And most rusty nuts have the courage of their convictions.

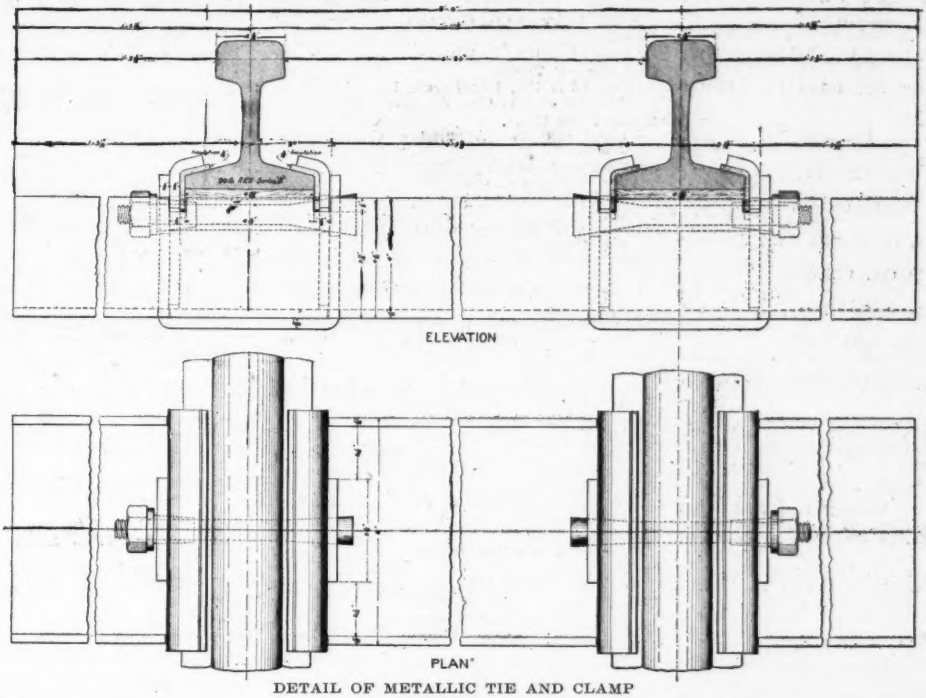
As a rule, they hold strategic positions, keeping at bay the laborer or mechanic possessing ordinary tools.

BUT THE GOOD GRIP OF A COES WRENCH IS IRRESISTIBLE. Through it, STUBBORNNESS is converted to OBEDIENCE—a revelation to the man who never used a COES WRENCH before.



COES WRENCH CO.

WORCESTER MASS



DETAIL OF METALLIC TIE AND CLAMP

Safety First and Economy Eventually

Are the Salient Features Embodied In

Universal Metallic Ties

First cost is practically the only cost, the slight difference above wooden tie installation being quickly overcome by the elimination of spikes, angle bars, rail anchors and brace chairs and their replacement — by greatly added life and scrap value of metal ties

Necessary Elasticity Imparted by Wooden Block Support

Now installed on main lines of

Pennsylvania Railroad	New York Central
Pittsburgh & Lake Erie	A., T. & S. F. Ry.
C., B. & Q.	Northern Pacific
Great Northern	S. L & L. A.

Bingham & Garfield

CATALOG ON REQUEST

Safe, Permanent Road-Bed

Universal Metallic Tie Co.

Karpen Bldg. **CHICAGO**

Kearns Bldg. **SALT LAKE CITY**

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Positive Rail Anchor Co., Louisville, Ky.

Annunciators.
United Electric Apparatus Co., Boston, Mass.

Asbestos Products.
Franklin Mfg. Co., Franklin, Pa.

Asbestos Roofing Slates.
Franklin Mfg. Co., Franklin, Pa.

Asbestos Sheathing.
Franklin Mfg. Co., Franklin, Pa.

Axle Washers.
Hubbard & Co., Pittsburgh, Pa.

Bar Benders.
Wallace Supply Co., Chicago.

Bars.
Hubbard & Co., Pittsburgh.

Battery Cells.
Edison, Thos. A., Inc., Orange, N. J.
Gordon Primary Battery Co., New York.
U. S. Light & Heating Co., New York.
Waterbury Battery Co., Waterbury, Conn.

Battery Renewals.
Edison, Thos. A., Inc., Orange, N. J.
Gordon Primary Battery Co., New York.
U. S. Light & Heating Co., New York.
Waterbury Battery Co., Waterbury, Conn.

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Edison, Thos. A., Inc., Orange, N. J.
Gordon Primary Battery Co., New York.
U. S. Light & Heating Co., New York.
Waterbury Battery Co., Waterbury, Conn.

Battery Zincs.
Edison, Thos. A., Inc., Orange, N. J.
Gordon Primary Battery Co., New York.
U. S. Light & Heating Co., New York.
Waterbury Battery Co., Waterbury, Conn.

Batteries, Electric.
Edison, Thos. A., Inc., Orange, N. J.
Gordon Primary Battery Co., New York.
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Waterbury Battery Co., Waterbury, Conn.

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Waterbury Battery Co., Waterbury, Conn.

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Wallace Supply Co., Chicago.

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Gale Installation Co., Chicago.

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Hubbard & Co., Pittsburgh.

Bonding Drills.
Kalamazoo Railway Supply Co., Kalamazoo, Michigan.

Books.
Clarke, Myron C., Pub. Co., Chicago.

Bridge Lights.
Gray, Peter, & Sons, Boston.

Bridge Paint.
Dixon, Jos., Crucible Co., Jersey City, N. J.

Bridges.
Chicago Bridge & Iron Works, Chicago.

Buckets Automatic Grab.
Williams, G. H., Co., Cleveland, O.

Buckets, Dump.
Industrial Supply & Equipment Co., Philadelphia, Pa.
Williams, G. H., Co., Cleveland, O.

Buckets, Excavating.
Industrial Supply & Equipment Co., Philadelphia, Pa.
Williams, G. H., Co., Cleveland, O.

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Franklin Mfg. Co., Franklin, Pa.

Bumping Posts.
Mechanical Mfg. Co., Chicago.
Railway & Traction Supply Co., Chicago.

Bunks.
Haggard & Marcusson, Chicago.

Burners, Lamp and Lantern.
Gray, Peter & Sons, Boston, Mass.

Cables.
Central Electric Co., Chicago.

Car Movers.
Atlas Railway Supply Co., Chicago.

Car Replacers.
Johnson Wrecking Frog Co., Cleveland, O.
Kalamazoo Railway Supply Co., Kalamazoo, Michigan.

Car Stoppers.
Railway & Traction Supply Co.
Southern Railway Supply Co., St. Louis, Mo.

Cars, Hand and Inspection (See Hand Cars, and Inspection Cars).

Cattle Guards.
Calumet Supply Mfg. Co., Harvey, Ill.
Kalamazoo Railway Supply Co., Kalamazoo, Mich.

Chairs.
A. H. Andrews Co., Chicago.

Chisels.
Hubbard & Co., Pittsburgh, Pa.

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Hubbard & Co., Pittsburgh, Pa.
Wyoming Shovel Co., Wyoming, Pa.

Contact Switches.
United Electric Apparatus Co., Boston, Mass.

Continuous Joints.
Atlas Supply Co., Chicago.
Rail Joint Co., New York.

Cranes.
Kalamazoo Railway Supply Co., Kalamazoo, Mich.
Nichols, Geo. P., & Bros., Chicago.

Crayons.
Dixon, Jos., Crucible Co., Jersey City, N. J.

Crossing Bells.
Hoeschen Manufacturing Co., Omaha, Neb.
United Electric Apparatus Co., Boston, Mass.

Crossing Signs.
Stonehouse Enameled Steel Sign Co., Denver, Colo.

Crossings (See Frogs and Crossings).

Danger Signs.
Stonehouse Enameled Steel Sign Co., Denver, Colo.

Derails.
Indianapolis Switch & Frog Co., Springfield, O.

Desks.
A. H. Andrews Co., Chicago.

Door Hangers.
Richards-Wilcox Mfg. Co., Aurora, Ill.

Dump Cars.
Clark Car Co. Pittsburgh, Pa.
Kalamazoo Railway Supply Co., Kalamazoo, Mich.

Electric Batteries.
See Batteries, Electric.

Electric Lights for Signal Lamps.
Gray, Peter, & Sons, Boston, Mass.

Engines, Gasoline (See Gasoline Engines).

Farm Gates.
Iowa Gate Co., Cedar Falls, Ia.

Fencing.
Calumet Supply Mfg. Co., Harvey, Ill.

Fence Posts.
Calumet Supply Mfg. Co., Harvey, Ill.

Fire Door Equipment.
Richards-Wilcox Mfg. Co., Aurora, Ill.

Frogs and Crossings.
Cincinnati Frog & Switch Co., Cincinnati.
Frog, Switch & Mfg. Co., Carlisle, Pa.
Indianapolis Switch & Frog Co., Springfield, O.
Ramapo Iron Works, Hillburn, N. Y.
Weir Frog Co., Cincinnati.

Gasoline Cars.
Associated Manufacturers Co., Waterloo, Iowa.
Fairmont Machine Co., Fairmont, Minn.
Kalamazoo Railway Supply Co., Kalamazoo, Mich.
Thompson, J., & Sons, Mfg. Co., Beloit, Wis.

Gasoline Engines.
Associated Manufacturers Co., Waterloo, Ia.
Fairmont Machine Co., Fairmont, Minn.
Kalamazoo Railway Supply Co., Kalamazoo, Mich.

Gasoline Motor Cars (See Motor Cars, Gasoline).

Gates, Right of Way.
Iowa Gate Co., Cedar Falls, Ia.

Grab Buckets.
Industrial Supply & Equipment Co., Philadelphia, Pa.
Williams, G. H., Co., Cleveland, O.

Graphite.
Dixon, Jos., Crucible Co., Jersey City, N. J.

Hand Car Motors.
Associated Manufacturers Co., Waterloo, Iowa.
Fairmont Machine Co., Fairmont, Minn.
Thompson, J., & Sons, Mfg. Co., Beloit, Wis.

Hand Cars.
Associated Manufacturers Co., Waterloo, Iowa.
Kalamazoo Railway Supply Co., Kalamazoo, Mich.

Heating and Ventilating Systems.
Gale Installation Co., Chicago.

Hoes.
Hubbard & Co., Pittsburgh, Pa.

Hoisting Machinery.
Verona Tool Works, Pittsburgh, Pa.

I-Beam Carrying System.
Richards-Wilcox Mfg. Co., Aurora, Ill.

Inspection Cars.
Associated Manufacturers Co., Waterloo, Ia.
Chicago Pneumatic Tool Co., Chicago.
Light Inspection Car Co., Hagerstown, Ind.
Kalamazoo Railway Supply Co., Kalamazoo, Mich.
Thompson, J., & Sons, Mfg. Co., Beloit, Wis.

Insulation and Insulating Material.
Central Electric Co., Chicago.
Okonite Co.

Lamps and Lanterns.
Gray, Peter, & Sons (Inc.), Boston.

Latches.
Richards-Wilcox Mfg. Co., Aurora, Ill.

Lightning Arresters.
United Electric Apparatus Co., Boston, Mass.

Line Material.
Electric Ry. & Equip. Co., Cincinnati, O.

Locks, Sliding Door.
Richards-Wilcox Mfg. Co., Aurora, Ill.

Locomotive Replacers.
Johnson Wrecking Frog Co., Cleveland, O.

Lubricants, Graphite.
Dixon, Jos., Crucible Co., Jersey City, N. J.

Lubrication, Graphite.
Dixon, Jos., Crucible Co., Jersey City, N. J.

Maintenance of Way Supplies.
Hubbard & Co., Pittsburg.
Kalamazoo Railway Supply Co., Kalamazoo, Mich.

Manganese Frogs and Crossings.
Cincinnati Frog & Switch Co., Cincinnati, O.
Frog, Switch & Mfg. Co., Carlisle, Pa.
Indianapolis Switch & Frog Co., Springfield, O.
Ramapo Iron Works, Hillburn, N. Y.
Weir Frog Co., Cincinnati, O.

Mast Arms.
Electric Ry. Equipment Co., Cincinnati.

Metal Protecting Paints.
Dixon, Joseph, Crucible Co., Jersey City, N. J.

Motor Cars.
Associated Manufacturers Co., Waterloo, Ia.
Chicago Pneumatic Tool Co., Chicago.
Fairmont Machine Co., Fairmont, Minn.
Kalamazoo Railway Supply Co., Kalamazoo, Mich.
Thompson, J., & Sons, Mfg. Co., Beloit, Wis.

Motors, Gasoline.
Associated Manufacturers Co., Waterloo, Ia.
Fairmont Machine Co., Fairmont, Minn.
Thompson, J., & Sons, Mfg. Co., Beloit, Wis.

Oil Cans.
Gray, Peter, & Sons, Boston, Mass.

Oil Storage Systems.
Bowser, S. F., & Co., Ft. Wayne, Ind.

Oil Tanks.
Bowser, S. F., & Co., Ft. Wayne, Ind.
Chicago Bridge & Iron Works, Chicago.

Overhead Carriers.
Richards-Wilcox Mfg. Co., Aurora, Ill.

Paints.
Dixon, Joseph, Crucible Co., Jersey City, N. J.

Parallel Door Hangers.
Richards-Wilcox Mfg. Co., Aurora, Ill.

Parallel Door Hardware.
Richards-Wilcox Mfg. Co., Aurora, Ill.

Pencils.
Dixon, Jos., Crucible Co., Jersey City, N. J.

Picks.
Hubbard & Co., Pittsburg, Pa.

Plate. (See Tie Plates.)

Plows, Unloading.
Bucyrus Co., S. Milwaukee, Wis.

Pole Line Material.
Electric Ry. Equip. Co., Cincinnati.
Hubbard & Co., Pittsburg, Pa.

Poles, Steel.
Electric Ry. Equip. Co., Cincinnati.

Post Hole Diggers.
Hubbard & Co., Pittsburg, Pa.

Power Plants.
Gale Installation Co., Chicago.

Push Cars.
Kalamazoo Railway Supply Co., Kalamazoo, Mich.

Publications.
Clarke, Myron C., Pub. Co., Chicago.

Push Cars.
Associated Manufacturers Co., Waterloo, Ia.

Pumps.
Blackmer Rotary Pump, Power & Mfg. Co., Petoskey, Mich.

Pumps, Oil.
Bowser, S. F., & Co., Ft. Wayne, Ind.

Rail Anchors.
Positive Rail Anchor Co., Louisville, Ky.

Rail Anchor, One Piece.
Positive Rail Anchor Co., Louisville, Ky.

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Rail Benders.
Kalamazoo Railway Supply Co., Kalamazoo, Mich.

Rail Braces.
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Cincinnati Frog & Switch Co., Cincinnati, O.
Indianapolis Switch & Frog Co., Springfield, O.
Weir Frog Co., Cincinnati.

Rail Drills.
Indianapolis Switch & Frog Co., Springfield, O.

Rail Joints.
Atlas Railway Supply Co., Chicago.
International Interlocking Rail Joint Co., Chicago.
Rail Joint Co., New York City.
Weir Frog Co., Cincinnati, O.

Railway Equipment and Supplies.
American Valve & Meter Co., Cincinnati, O.
Atlas Railway Supply Co., Chicago.
Frog, Switch & Mfg. Co., Carlisle, Pa.
Indianapolis Switch & Frog Co., Springfield, O.
Industrial Supply & Equipment Co., Philadelphia, Pa.
Kalamazoo Railway Supply Co., Kalamazoo, Mich.
Rail Joint Co., New York.
Ramapo Iron Works, Hillburn, N. Y.
Weir Frog Co., Cincinnati.

Reinforcing Bar Benders.
Wallace Supply Co., Chicago.

Relays, Track.
United Electric Apparatus Co., Boston, Mass.

Replacers, Car and Engine.
Johnson Wrecking Frog Co., Cleveland, O.

Right-of-Way Gates.
Iowa Gate Co., Cedar Falls, Ia.

Roofing Materials, Asbestos.
Franklin Mfg. Co., Franklin, Pa.

Rotary Pumps.
Blackmer Rotary Pump, Power & Mfg. Co., Petoskey, Mich.

Roundhouse Asbestos.
Franklin Mfg. Co., Franklin, Pa.

Screw Spikes.
Hart Steel Co., Elyria, O.

Section Cars, Gasoline.
Associated Manufacturers Co., Waterloo, Ia.
Chicago Pneumatic Tool Co., Chicago.
Kalamazoo Railway Supply Co., Kalamazoo, Mich.
Thompson, J., & Sons, Mfg. Co., Beloit, Wis.

Settees.
A. H. Andrews Co., Chicago.

Sheathing, Asbestos.
Franklin Mfg. Co., Franklin, Pa.

Sheet Metal.
Gray, Peter, & Sons, Boston.

Shingles, Asbestos.
Franklin Mfg. Co., Franklin, Pa.

Shovel Handles.
Wyoming Shovel Wks., Wyoming, Pa.

Shovels, Spades and Scoops.
Hubbard & Co., Pittsburg, Pa.
Wyoming Shovel Wks., Wyoming, Pa.

Signal Lamps.
Gray, Peter, & Sons, Boston.

Signs.
Stonehouse Enameled Steel Co., Denver, Colo.

Smoke Jacks, Asbestos.
Franklin Mfg. Co., Franklin, Pa.

Spark Coils.
Edison, Thos. A., Inc., Orange, N. J.

Spikes.
Dilworth Porter & Co., Pittsburg
Hart Steel Co., Elyria, O.

Station Settees.
A. H. Andrews Co., Chicago.

Steam Shovels.
Bucyrus Co., S. Milwaukee, Wis.

Steel Bumping Posts.
Railway & Traction Supply Co., Chicago.

Steel Bunks.
Haggard & Marcusson Co., Chicago.

Steel Gates.
Iowa Gate Co., Cedar Falls, Ia.

Steel Plate Work.
Chicago Bridge & Iron Works, Chicago.

Steel, Structural.
Chicago Bridge & Iron Works, Chicago.

Storage Batteries.
U. S. Light & Heating Co., New York.

Striking Hammers.
Hubbard & Co., Pittsburg, Pa.

Switch Lanterns.
Gray, Peter, & Sons, Boston.

Switch Rods.
Weir Frog Co., Cincinnati, O.
Ramapo Iron Works, Hillburn, N. Y.

Switches and Switch Stands.
American Valve & Meter Co., Cincinnati, O.
Atlas Railway Supply Co., Chicago.
Cincinnati Frog & Switch Co., Cincinnati.
Frog, Switch & Mfg. Co., Carlisle, Pa.
Indianapolis Switch & Frog Co., Springfield, O.
Ramapo Iron Works, Hillburn, N. Y.
Weir Frog Co., Cincinnati.

Switchboard Adjusters.
Weir Frog Co., Cincinnati.

Tanks and Tank Fixtures.
Bowser, S. F., & Co., Ft. Wayne, Ind.
Chicago Bridge & Iron Works, Chicago.
Kalamazoo Railway Supply Co., Kalamazoo, Mich.

Telegraph and Telephone Supplies.
Central Electric Co., Chicago.
Hubbard & Co., Pittsburg.

Terminal Blocks.
United Electric Apparatus Co., Boston, Mass.

Tie Plate and Anti Creeper.
Positive Rail Anchor Co., Louisville, Ky.

Tie Plates.
Atlas Railway Supply Co., Chicago.
Dilworth Porter & Co., Pittsburg.
Hart Steel Co., Elyria, O.

Ties, Concrete.
Sisk Universal Concrete Tie Co., San Francisco, Cal.

Ties, Steel.
Universal Metallic Tie Co., Salt Lake City, Utah.

Track Drills.
Cooks Standard Tool Co., Kalamazoo, Mich.
Kalamazoo Railway Supply Co., Kalamazoo, Mich.

Track Jacks.
Cooks Standard Tool Co., Kalamazoo, Mich.
Kalamazoo Railway Supply Co., Kalamazoo, Mich.

Track Laying Cars.
Kalamazoo Railway Supply Co., Kalamazoo, Mich.

Track Materials.
Atlas Railway Supply Co., Chicago.
Frog, Switch & Mfg. Co., Carlisle, Pa.
Indianapolis Switch & Frog Co., Springfield, O.
Ramapo Iron Works, Hillburn, N. Y.
Verona Tool Works, Pittsburg, Pa.
Weir Frog Co., Cincinnati.

Track Tools.
Cooks Standard Tool Co., Kalamazoo, Mich.
Hubbard & Co., Pittsburg, Pa.
Kalamazoo Railway Supply Co., Kalamazoo, Mich.
Verona Tool Works, Pittsburg, Pa.
Wyoming Shovel Works, Wyoming, Pa.

Transfer Tables.
Nichols, Geo. P., & Bro., Chicago.

Trolley Brackets.
Electric Ry. & Equip. Co., Cincinnati, O.

Turntable Tractors.
Nichols, Geo. P., & Bro., Chicago.

Turntables.
Chicago Bridge & Iron Works, Chicago.
Nichols, Geo. P., & Bro., Chicago.

Valve Grease, Graphite.
Dixon, Joseph, Crucible Co., Jersey City, N. J.

Velocipede Cars.
Kalamazoo Railway Supply Co., Kalamazoo, Mich.

Ventilating System.
Gale Installation Co., Chicago.

Washers.
Hubbard & Co., Pittsburg, Pa.

Water Columns.
Kalamazoo Railway Supply Co., Kalamazoo, Mich.

Water Coolers.
Gray, Peter, & Sons, Boston.

Water Filters.
International Wagner Water Still Co., Chicago.
Pittsburg Filter Mfg. Co., Pittsburg, Pa.

Water Softeners.
Booth, L. M., Co., New York, N. Y.
International Wagner Water Still Co., Chicago.
Pittsburg Filter Mfg. Co., Pittsburg, Pa.

Water Stills.
International Wagner Water Still Co., Chicago.

Wedges.
Hubbard & Co., Pittsburg, Pa.

Wheelbarrows.
Kalamazoo Railway Supply Co., Kalamazoo, Mich.

Wing Fence Aprons.
Calumet Supply Co., Calumet, Ill.

Wires.
Central Electric Co., Chicago.

Wire Tapes and Cords.
Central Electric Co., Chicago.

Wrecking Frogs.
Johnson Wrecking Frog Co., Cleveland, O.

Wrenches.
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Zincs.
Edison, Thos. A., Inc., Orange, N. J.

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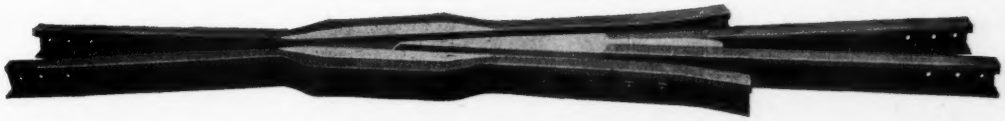
The Scale of Lower Prices

Our lower prices will not be based on the value of Manganese steel to YOU, but on what it costs us to make the castings.



Our Manganese Track Work

is entitled to be used on every Railroad, because it is made by experts whose first THOUGHT IS SERVICE.

Will you look at some of our printed matter?

FROG SWITCH & MANUFACTURING CO
CARLISLE, PA.